AVX CORPORATION
A KYOCERA GROUP COMPANY

Surface Mount Tantalum Capacitors

AVX Tantalum
Ask The World Of Us

As the world's broadest line molded tantalum chip supplier, it is our mission to provide **First In Class** Technology, Quality and Service, by establishing progressive design, manufacturing and continuous improvement programs driving toward a single goal:

TOTAL CUSTOMER SATISFACTION

QV2000

Foreword

AVX offers a broad line of molded solid tantalum capacitors in a wide range of sizes, styles, and ratings to meet your design needs. This catalog combines into one source AVX's SMD tantalum capacitor information from its worldwide tantalum operations.

The TAJ series includes EIA standard case sizes and ratings, along with extended range values and six new case sizes which include low profile packages and EIAJ standard sizes. The TAJ is qualified as MIL-style CWR11.

A new series is the TAS fused tantalum SMD for filtering and decoupling in computer and telecommunication applications.

The TAZ series is qualified as the CWR09 style, the molded equivalent of the CWR06 style. Two new case sizes are added to this series, increasing the capacitance/voltage ratings available for both low and high values. Extended range values are also available in all series.

AVX offers tantalum applications service for use by our customers, please contact your local representative if you wish to discuss any special requirements.

AVX has become a world leader in tantalum capacitor technology and has made, and is continuing to make significant investments in equipment and research to maintain that leadership.

Contents

Index — Professional Series 2
Index — Military Series 2
Section 1 — Professional Products 3-19
Section 2 — Military Products 20-25
Section 3 — Technical Summary and Application Guidelines 26-40

Surface Mount Tantalum Capacitors

Section 1 — Professional Series

Page

Index: Introduction to AVX SMD Tantalum Capacitors 3

TAJ EIA Standard Surface Mount Tantalum Capacitors

QUALIFICATIONS: CECC 30801-005
IECQ PQC-32 GB0003
EIA 535 BAAC (IEC QC 300801/US 0001)

TAJ Standard Range Ordering Information and Dimensions 4
TAJ Standard Range Case Size Matrix 5
TAJ Extended Range Case Size Matrix 5
TAJ Low Profile Dimensions and Case Size Matrix 7
TAJ Series Ratings and Part Number Reference 8
Tape & Reel Packaging 13

TAS Surface Mount Tantalum Capacitors Incorporating Integral Fuse

QUALIFICATIONS: EIA 535 BAAC
(IEC QC 30080)

TAS Series Dimensions and Case Size Matrix 10
TAS Series Ratings and Part Number Reference 11
Tape & Reel Packaging 13

TAZ Surface Mount Tantalum Capacitors

TAZ Series Dimensions and Standard Range 14
TAZ Series Extended Range and Special Case Sizes 17
TAZ Series Ratings and Part Number Reference 18
Tape & Reel Packaging 25

Section 2 — Military Series

CWR09 Surface Mount Tantalum Capacitors

QUALIFICATIONS: MIL-C-55365/4 (Rev C)
Style CWR09

CWR09 Ordering Information 20
CWR09 Ratings and Part Number Reference 21

CWR11 Surface Mount Tantalum Capacitors

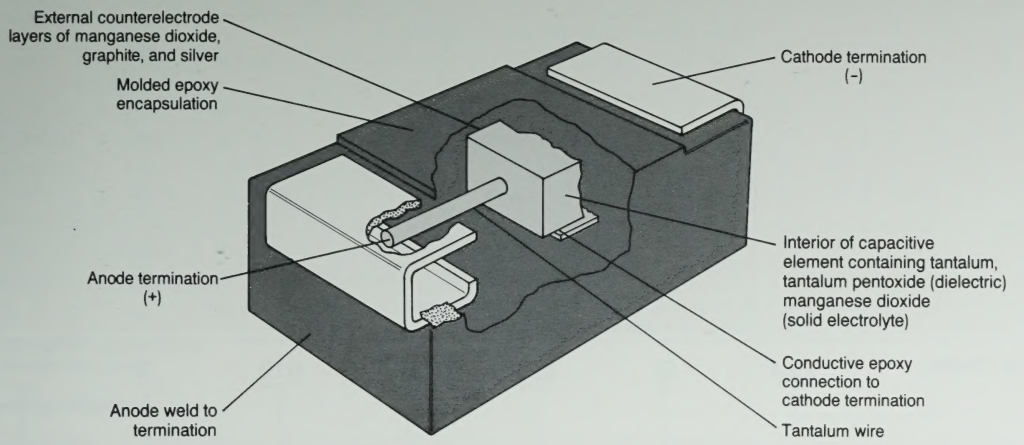
QUALIFICATIONS: MIL-C—55365/8 (Rev C)
Style CWR11

CWR11 Ordering Information 23
CWR11 Ratings and Part Number Reference 24

Section 1 — TAJ, TAS and TAZ

The AVX series of molded tantalum chips are designed for surface mount applications and are equally suitable for hybrid applications. They are tape and reel packaged for high volume automatic assembly techniques.

Construction (non-fused styles)


External counterelectrode layers of manganese dioxide, graphite, and silver
Molded epoxy encapsulation
Cathode termination (-)
Interior of capacitive element containing tantalum, tantalum pentoxide (dielectric) manganese dioxide (solid electrolyte)
Anode termination (+)
Conductive epoxy connection to cathode termination
Anode weld to termination
Tantalum wire

Design and Application Features

1. Flat top surface for high speed pick-up — compatible with high speed automatic onsertion equipment.
2. Regular molded shape — allows accurate transfer and placement during onsertion.
3. Glue pads on underside of TAJ/TAS ranges permits consistent, strong bonding to circuit board prior to soldering.
4. Consistent termination dimensions — allows reliable pad design and a consistent "fit" — helps to eliminate "tombstoning" or "jumping bean" effects and reduces rotational effects.
5. Compliant terminations — transfer of thermo-mechanical stresses during operation and mechanical stresses during equipment servicing to the component are reduced.
6. Rugged construction helps to prevent damage during mounting and to ensure compatibility with all systems for soldering (infra-red, wave solder, reflow solder, vapor phase) and conductive epoxy resin mounting techniques.
7. Resistant to flux removal solvents including Aqueous systems used with vapor phase soldering.
8. All parts are coded on uppermost surface with videcon-readable polarity marking.
9. High density packaging on 8 and 12 mm blister tape, available on 7″ and 13″ reels.
10. Qualified to IECQ, CECC and MIL specifications.
11. Now available with integral fuse.
12. New low profile case sizes including the new "R" case compatible with "0805" footprint.

Surface Mount Tantalum Capacitors

TAJ Series — Solid Tantalum Chip Capacitors (EIA Standard)

The TAJ standard series encompasses the four key sizes recognized by major OEMs throughout the world, together with the new high profile E case (7343H size) and two cases conforming to the EIA-J standard.

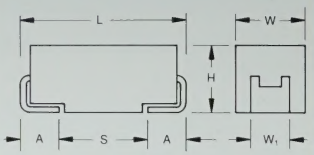
Available with standard capacitance tolerances of ±10% and ±20%.

Operational temperature -55°C to +85°C at rated voltage and up to +125°C with voltage derating.

TAJ is available in standard and extended ranges.

Note on sizes: A, B, C, D - EIA standard EIA-535BAAC
E - Extended range (high profile D case, 7343H)
M, N - EIA-J standard

For CWR11 ratings see pages 23 and 24.



Case Dimensions inches (millimeters)

Code	EIA Code	L±0.008 (0.2)	W+0.008 (0.2) -0.004 (0.1)	H+0.008 (0.2) -0.004 (0.1)	W_1±0.008 (0.2)	A+0.012 (0.3) -0.008 (0.2)	S Min.
A	3216	0.126 (3.2)	0.063 (1.6)	0.063 (1.6)	0.047 (1.2)	0.031 (0.8)	0.043 (1.1)
B	3528	0.138 (3.5)	0.110 (2.8)	0.075 (1.9)	0.087 (2.2)	0.031 (0.8)	0.055 (1.4)
C	6032	0.236 (6.0)	0.126 (3.2)	0.102 (2.6)	0.087 (2.2)	0.051 (1.3)	0.114 (2.9)
D	7343	0.287 (7.3)	0.169 (4.3)	0.114 (2.9)	0.094 (2.4)	0.051 (1.3)	0.173 (4.4)
E	7343H	0.287 (7.3)	0.169 (4.3)	0.162 (4.1)	0.094 (2.4)	0.051 (1.3)	0.173 (4.4)
M	4726*	0.185 (4.7)	0.102 (2.6)	0.083 (2.1)	0.055 (1.4)	0.031 (0.8)	0.106 (2.7)
N	5846*	0.228 (5.8)	0.181 (4.6)	0.126 (3.2)	0.094 (2.4)	0.051 (1.3)	0.110 (2.8)

W_1 dimension applies to the termination width for A dimensional area only.
*EIA-J Case Reference

How to Order:

TAJ	B	335	M	016	R	**

Type

Case Code (See table above)

Capacitance Code
pF code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow)

Tolerance
K=±10%, M=±20%, (J=±5%, consult factory for details)

Rated DC Voltage

Packaging (Consult page 13 for details)

Additional characters may be added for special requirements

Technical Data:		All technical data relate to an ambient temperature of +25°C							
Capacitance Range:		0.1 µF to 220 µF							
Capacitance Tolerance:		±20%; ±10% (+5% special order)							
Rated Voltage DC (V_R)	≦+85°C:	4	6.3	10	16	20	25	35	50
Category Voltage (V_C)	≦+125°C:	2.5	4	6.3	10	13	16	23	33
Surge Voltage (V_S)	≦+85°C:	5.2	8	13	20	26	33	46	65
	≦+125°C:	3.5	5	9	12	16	21	28	40
Temperature Range:		-55°C to +125°C							
Environmental Classification:		55/125/56 (IEC 68-2)							
Dissipation Factor:		≦0.04 for C_R ≦1.0 µF							
		≦0.06 for C_R >1.0 µF							
		≦0.08 for E case with C_R ≧100 µF							

Surface Mount Tantalum Capacitors

TAJ Series — Solid Tantalum Chip Capacitors (EIA Standard)

Standard Range (EIA and EIA-J sizes). See below for extended range.

Capacitance Range (letter denotes case code)															
Capacitance		Rated voltage DC (V_R)													
		4V		6.3V		10V		16V		20V		25V		35V		50V	
µF	Code	Std.	Alt.	Std.	Alt.	Std.	Alt.	Std.	Alt.	Std.	Alt.	Std.	Alt.	Std.	Alt.	Std.	Alt.
0.1	104													A		A	
0.15	154													A		B	
0.22	224													A		B	
0.33	334													A		B	
0.47	474											A		B	M	C	
0.68	684									A				B	M	C	
1.0	105							A		A				B	M	C	
1.5	155					A		A				B	M	C		D	
2.2	225			A		A		B	M	B	M			C		D	
3.3	335	A		A				B	M	B	M	C		C		D	
4.7	475	A				B	M	B	M	C		C		D		D	
6.8	685			B	M	B	M	C		C		D		D	N		
10	106	B	M	B	M	C		C				D	N	D	N		
15	156	B	M	C		C				D		D	N				
22	226	C		C				D		D	N						
33	336	C				D		D	N								
47	476	D		D		D	N										
68	686	D		D	N			E									
100	107	D	N			E											

"Std" denotes EIA standard sizes
"Alt" denotes EIA J sizes

Extended Range

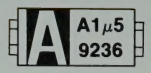
Capacitance Range (letter denotes case code)									
Capacitance		Rated voltage DC (V_R)							
µF	Code	4V	6.3V	10V	16V	20V	25V	35V	50V
0.1	104								
0.15	154								A
0.22	224								
0.33	334								
0.47	474							A	B
0.68	684						A	A	
1.0	105						A		
1.5	155					A		B	C
2.2	225				A		B	B	
3.3	335			A	A		B		
4.7	475		A	A		B		C	
6.8	685	A	A		B		C		D
10	106	A	A	B	B	C	C		E
15	156		B	B	C	C		D	
22	226	B	B	C	C		D	E	
33	336	B	C	C		D	E		
47	476	C	C		D	E			
68	686	C		D	D	E			
100	107		D	D	E				
150	157	D	D	E					
220	227	E	E	E					
330	337	E	E						

Ratings outside this matrix may be available upon request.

Marking: TAJ Series

For TAJ, the positive end of body has videcon readable polarity bar marking, with the AVX logo "A" as shown in the diagram. Bodies are marked by indelible laser marking on top surface with capacitance value, voltage and date of manufacture. Due to the small size of the A, B, M, R, S and T cases, a voltage code is used as shown below:

Voltage Code A, B, S and T Cases	Rated Voltage at 85°C
G	4
J	6.3
A	10
C	16
D	20
E	25
V	35
T	50



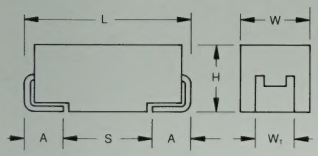
A, B, M, R, S and T Case:
Voltage Code
(see table)
Capacitance in μF
Date Code

C, D, E and N Case:
Capacitance in μF
Rated Voltage
at 85°C
Date Code

Surface Mount Tantalum Capacitors

TAJ Series — Low Profile Solid Tantalum Chip Capacitors (EIA Standard)

Three additional case sizes are available in the TAJ range offering ultra low profile solid tantalum chip capacitors. Designed for applications where maximum height of components above or below board are of prime consideration, this height of 1.2mm equates to that of a standard integrated circuit package after mounting. Also available is the ultra compact 0805 equivalent in a fully molded package. The S&T footprints are identical to the A&B case size parts.



Case Dimensions inches (millimeters—Metric Dimensions Govern)

Code	EIA Code	L±0.008 (0.2)	W+0.008 (0.2) -0.004 (0.1)	H max.	W_1 ±0.004 (0.1)	A+0.012 (0.3) -.004 (0.1)	S Min.
0805 Equivalent							
R	2012	0.08 (2.05)	0.05 (1.3)	0.047 (1.2)	0.047 (1.2)	0.020 (0.5)	0.033 (0.85)
Low Profile Versions of A & B Case							
S	3216L	0.12 (3.2)	0.06 (1.6)	0.047 (1.2)	0.047 (1.2)	0.031 (0.8)	0.043 (1.1)
T	3528L	0.14 (3.5)	0.11 (2.8)	0.047 (1.2)	0.087 (2.2)	0.031 (0.8)	0.055 (1.4)

W_1 dimension applies to the termination width for A dimensional area only.
Pad Stand-off is 0.1±0.1.

Capacitance and Voltage Range (letter denotes case code)

Capacitance		Rated voltage d.c.					
µF	Code	2V	4V	6.3V	10V	16V	20V
0.1	104						R/S
0.15	154						R/S
0.22	224						R/S
0.33	334						R/S
0.47	474						R/S
0.68	684					R/S	S/T
1.0	105				R/S	R/S	S/T
1.5	155			R/S	S	S	T
2.2	225		R/S	R/S	S	T	T
3.3	335		R/S	S	T	T	
4.7	475	R	S	T	T		
6.8	685	R	T	T			
10	106		T				

How to Order:

TAJ R 105 K 010 R **

Type

Case Code
(See table above)

Capacitance Code
pF code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow)

Tolerance
K=±10%, M=±20%, (J=±5%, consult factory for details)

Rated DC Voltage

Packaging
(Consult page 13 for details)

Additional characters may be added for special requirements

TAJ Series — Solid Tantalum Chip Capacitors

Ratings and Part Number Reference

AVX Part No.	Case Size	Capacitance µF	DCL (µA) Max.	DF % Max.	ESR max. (Ω) @ 100 kHz
2 volt @ 85°C (1.3 volt @ 125°C)					
TAJR475(•)002	R	4.7	0.5	6	25.0
TAJR685(•)002	R	6.8	0.5	6	25.0
4 volt @ 85°C (2.5 volt @ 125°C)					
TAJR225(•)004	R	2.2	0.5	6	25.0
TAJS225(•)004	S	2.2	0.5	6	25.0
TAJA335(•)004	A	3.3	0.5	6	20.0
TAJR335(•)004	R	3.3	0.5	6	20.0
TAJS335(•)004	S	3.3	0.5	6	18.0
TAJS475(•)004	S	4.7	0.5	6	16.0
TAJA475(•)004	A	4.7	0.5	6	8.0
TAJA685(•)004	A	6.8	0.5	6	6.0
TAJT685(•)004	T	6.8	0.5	6	6.0
TAJA106(•)004	A	10	0.5	6	5.0
TAJT106(•)004	T	10	0.5	6	5.0
TAJB106(•)004	B	10	0.5	6	4.5
TAJM106(•)004	M	10	0.5	6	4.5
TAJB156(•)004	B	15	0.6	6	3.5
TAJM156(•)004	M	15	0.6	6	3.0
TAJB226(•)004	B	22	0.9	6	3.0
TAJC226(•)004	C	22	0.9	6	3.0
TAJB336(•)004	B	33	1.4	6	3.0
TAJC336(•)004	C	33	1.4	6	2.5
TAJC476(•)004	C	47	1.9	6	2.2
TAJD476(•)004	D	47	1.9	6	2.0
TAJC686(•)004	C	68	2.7	6	1.8
TAJD686(•)004	D	68	2.7	6	1.8
TAJD107(•)004	D	100	4.0	6	1.0
TAJN107(•)004	N	100	4.0	6	1.0
TAJD157(•)004	D	150	6.0	6	0.9
TAJE227(•)004	E	220	8.8	8	0.9
TAJE337(•)004	E	330	13.2	8	0.9
6.3 volt @ 85°C (4 volt @ 125°C)					
TAJR155(•)006	R	1.5	0.5	6	25.0
TAJS155(•)006	S	1.5	0.5	6	25.0
TAJR225(•)006	R	2.2	0.5	6	20.0
TAJS225(•)006	S	2.2	0.5	6	20.0
TAJA225(•)006	A	2.2	0.5	6	15.0
TAJS335(•)006	S	3.3	0.5	6	15.0
TAJA335(•)006	A	3.3	0.5	6	7.0
TAJA475(•)006	A	4.7	0.5	6	6.0
TAJT475(•)006	T	4.7	0.5	6	6.0
TAJA685(•)006	A	6.8	0.5	6	5.0
TAJT685(•)006	T	6.8	0.5	6	5.0
TAJB685(•)006	B	6.8	0.5	6	4.5
TAJM685(•)006	M	6.8	0.5	6	5.0
TAJA106(•)006	A	10	0.6	6	4.0
TAJB106(•)006	B	10	0.6	6	3.0
TAJM106(•)006	M	10	0.6	6	3.0
TAJB156(•)006	B	15	1.0	6	2.5
TAJC156(•)006	C	15	1.0	6	2.3
TAJB226(•)006	B	22	1.4	6	2.3
TAJC226(•)006	C	22	1.4	6	2.0
TAJC336(•)006	C	33	2.1	6	2.0
TAJC476(•)006	C	47	3.0	6	1.8
TAJD476(•)006	D	47	3.0	6	1.8
TAJN686(•)006	N	68	4.3	6	1.0
TAJD686(•)006	D	68	4.3	6	1.0
TAJD107(•)006	D	100	6.3	6	0.9
TAJD157(•)006	D	150	9.0	6	0.9
TAJE227(•)006	E	220	13.2	8	0.9
TAJE337(•)006	E	330	19.8	8	0.7

AVX Part No.	Case Size	Capacitance µF	DCL (µA) Max.	DF % Max.	ESR max. (Ω) @ 100 kHz
10 volt @ 85°C (6.3 volt @ 125°C)					
TAJR105(•)010	R	1.0	0.5	4	25.0
TAJS105(•)010	S	1.0	0.5	4	25.0
TAJS155(•)010	S	1.5	0.5	6	20.0
TAJA155(•)010	A	1.5	0.5	6	15.0
TAJS225(•)010	S	2.2	0.5	6	7.0
TAJA225(•)010	A	2.2	0.5	6	7.0
TAJA335(•)010	A	3.3	0.5	6	5.5
TAJT335(•)010	T	3.3	0.5	6	6.0
TAJA475(•)010	A	4.7	0.5	6	5.0
TAJT475(•)010	T	4.7	0.5	6	5.0
TAJB475(•)010	B	4.7	0.5	6	4.5
TAJM475(•)010	M	4.7	0.5	6	4.5
TAJA475(•)010	A	4.7	0.5	6	5.0
TAJB475(•)010	B	4.7	0.5	6	4.5
TAJM475(•)010	M	4.7	0.5	6	4.5
TAJB685(•)010	B	6.8	0.7	6	3.0
TAJM685(•)010	M	6.8	0.7	6	3.0
TAJB106(•)010	B	10	1.0	6	2.5
TAJB156(•)010	B	15	1.5	6	2.5
TAJC106(•)010	C	10	1.0	6	2.5
TAJC156(•)010	C	15	1.5	6	2.0
TAJC226(•)010	C	22	2.2	6	2.0
TAJC336(•)010	C	33	3.3	6	1.8
TAJD336(•)010	D	33	3.3	6	1.8
TAJD476(•)010	D	47	4.7	6	1.0
TAJN476(•)010	N	47	4.7	6	1.0
TAJD686(•)010	D	68	6.8	6	1.0
TAJD107(•)010	D	100	10.0	6	0.9
TAJE107(•)010	E	100	10.0	6	0.9
TAJD157(•)010	E	150	15.0	6	0.9
TAJE227(•)010	E	220	22.0	8	0.9
16 volt @ 85°C (10 volt @ 125°C)					
TAJR684(•)016	R	0.68	0.5	4	25.0
TAJS684(•)016	S	0.68	0.5	4	25.0
TAJR105(•)016	R	1.0	0.5	4	25.0
TAJS105(•)016	S	1.0	0.5	4	20.0
TAJA105(•)016	A	1.0	0.5	4	15.0
TAJS155(•)016	S	1.5	0.5	6	15.0
TAJA155(•)016	A	1.5	0.5	6	8.0
TAJA225(•)016	A	2.2	0.5	6	6.5
TAJB225(•)016	B	2.2	0.5	6	6.5
TAJM225(•)016	M	2.2	0.5	6	6.5
TAJT225(•)016	T	2.2	0.5	6	6.5
TAJA335(•)016	A	3.3	0.5	6	5.0
TAJT335(•)016	T	3.3	0.5	6	5.0
TAJB335(•)016	B	3.3	0.5	6	5.0
TAJM335(•)016	M	3.3	0.5	6	5.0
TAJB475(•)016	B	4.7	0.8	6	3.0
TAJM475(•)016	M	4.7	0.8	6	3.0
TAJB685(•)016	B	6.8	1.1	6	2.5
TAJC685(•)016	C	6.8	1.1	6	2.5
TAJB106(•)016	B	10	1.6	6	2.5
TAJC106(•)016	C	10	1.6	6	2.0
TAJC156(•)016	C	15	2.4	6	2.0
TAJC226(•)016	C	22	3.5	6	1.8
TAJD226(•)016	D	22	3.5	6	1.8
TAJD336(•)016	D	33	5.3	6	1.0
TAJN336(•)016	N	33	5.3	6	1.0
TAJD476(•)016	D	47	7.5	6	0.9
TAJD686(•)016	D	68	10.8	6	0.9
TAJE686(•)016	E	68	10.8	6	0.9
TAJE107(•)016	E	100	16.0	6	0.9

For 10% tolerance, insert 'K' in (*) above.
For 20% tolerance, insert 'M' in (*) above. (K tolerance may be supplied in lieu of M tolerance.)
NOTE: Voltage ratings are minimum values. We reserve the right to supply higher voltage ratings in the same case size, to the same reliability standards.

Ratings and Part Number Reference (cont'd)

AVX Part No.	Case Size	Capacitance µF	DCL (µA) Max.	DF % Max.	ESR max. (Ω) @ 100 kHz
20 volt @ 85°C (13 volt @ 125°C)					
TAJR104(•)020	R	0.10	0.5	4	25.0
TAJS104(•)020	S	0.10	0.5	4	25.0
TAJR154(•)020	R	0.15	0.5	4	25.0
TAJS154(•)020	S	0.15	0.5	4	25.0
TAJR224(•)020	R	0.22	0.5	4	25.0
TAJS224(•)020	S	0.22	0.5	4	25.0
TAJR334(•)020	R	0.33	0.5	4	25.0
TAJS334(•)020	S	0.33	0.5	4	25.0
TAJR474(•)020	R	0.47	0.5	4	25.0
TAJS474(•)020	S	0.47	0.5	4	25.0
TAJA684(•)020	A	0.68	0.5	4	15.0
TAJT684(•)020	T	0.68	0.5	4	15.0
TAJS684(•)020	S	0.68	0.5	4	15.0
TAJA105(•)020	A	1.0	0.5	4	9.0
TAJS105(•)020	S	1.0	0.5	4	15.0
TAJT105(•)020	T	1.0	0.5	4	9.0
TAJA155(•)020	A	1.5	0.5	6	6.5
TAJT155(•)020	T	1.5	0.5	6	6.5
TAJT225(•)020	T	2.2	0.5	6	6.5
TAJB225(•)020	B	2.2	0.5	6	3.5
TAJM225(•)020	M	2.2	0.5	6	3.5
TAJB335(•)020	B	3.3	0.7	6	3.0
TAJM335(•)020	M	3.3	0.7	6	3.0
TAJB475(•)020	B	4.7	1.0	6	3.0
TAJC475(•)020	C	4.7	1.0	6	3.0
TAJC685(•)020	C	6.8	1.4	6	2.5
TAJC106(•)020	C	10	2.0	6	2.2
TAJC156(•)020	C	15	3.0	6	1.8
TAJD156(•)020	D	15	3.0	6	1.8
TAJD226(•)020	D	22	4.4	6	1.0
TAJN226(•)020	N	22	4.4	6	1.0
TAJD336(•)020	D	33	6.6	6	0.9
TAJE476(•)020	E	47	9.4	6	0.7
TAJE686(•)020	E	68	13.6	6	0.7
25 volt @ 85°C (16 volt @ 125°C)					
TAJA474(•)025	A	0.47	0.5	4	14.0
TAJA684(•)025	A	0.68	0.5	4	10.0
TAJA105(•)025	A	1.0	0.5	4	10.0
TAJB155(•)025	B	1.5	0.5	6	3.5
TAJM155(•)025	M	1.5	0.5	6	3.5
TAJB225(•)025	B	2.2	0.6	6	3.5
TAJB335(•)025	B	3.3	0.9	6	3.5
TAJC335(•)025	C	3.3	0.9	6	3.5
TAJC475(•)025	C	4.7	1.2	6	2.5
TAJC685(•)025	C	6.8	1.7	6	2.0
TAJD685(•)025	D	6.8	1.7	6	2.0
TAJC106(•)025	C	10	2.5	6	2.0
TAJD106(•)025	D	10	2.5	6	2.0
TAJN106(•)025	N	10	2.5	6	2.0
TAJD156(•)025	D	15	3.8	6	1.0
TAJN156(•)025	N	15	3.8	6	1.0
TAJD226(•)025	D	22	5.5	6	0.9
TAJE336(•)025	E	33	8.3	6	0.7

AVX Part No.	Case Size	Capacitance µF	DCL (µA) Max.	DF % Max.	ESR max. (Ω) @ 100 kHz
35 volt @ 85°C (23 volt @ 125°C)					
TAJA104(•)035	A	0.1	0.5	4	15.0
TAJA154(•)035	A	0.15	0.5	4	15.0
TAJA224(•)035	A	0.22	0.5	4	15.0
TAJA334(•)035	A	0.33	0.5	4	14.0
TAJA474(•)035	A	0.47	0.5	4	12.0
TAJB474(•)035	B	0.47	0.5	4	11.0
TAJM474(•)035	M	0.47	0.5	4	11.0
TAJA684(•)035	A	0.68	0.5	4	8.0
TAJB684(•)035	B	0.68	0.5	4	5.0
TAJM684(•)035	M	0.68	0.5	4	5.0
TAJB105(•)035	B	1.0	0.5	4	4.0
TAJM105(•)035	M	1.0	0.5	4	3.5
TAJB155(•)035	B	1.5	0.5	4	3.5
TAJC155(•)035	C	1.5	0.5	6	3.0
TAJB225(•)035	B	2.2	0.8	6	3.5
TAJC225(•)035	C	2.2	0.8	6	3.0
TAJC335(•)035	C	3.3	1.2	6	2.5
TAJC475(•)035	C	4.7	1.6	6	2.5
TAJD475(•)035	D	4.7	1.6	6	1.5
TAJD685(•)035	D	6.8	2.4	6	1.3
TAJN685(•)035	N	6.8	2.4	6	1.3
TAJD106(•)035	D	10	3.5	6	1.0
TAJN106(•)035	N	10	3.5	6	1.0
TAJD156(•)035	D	15	5.3	6	0.9
TAJE226(•)035	E	22	7.7	6	0.7
50 volt @ 85°C (33 volt @ 125°C)					
TAJA104(•)050	A	0.1	0.5	4	15.0
TAJA154(•)050	A	0.15	0.5	4	15.0
TAJB154(•)050	B	0.15	0.5	4	10.0
TAJB224(•)050	B	0.22	0.5	4	10.0
TAJB334(•)050	B	0.33	0.5	4	10.0
TAJB474(•)050	B	0.47	0.5	4	10.0
TAJC474(•)050	C	0.47	0.5	4	8.0
TAJC684(•)050	C	0.68	0.5	4	7.0
TAJC105(•)050	C	1.0	0.5	4	5.5
TAJC155(•)050	C	1.5	0.8	6	4.0
TAJD155(•)050	D	1.5	0.8	6	3.5
TAJD225(•)050	D	2.2	1.1	6	2.0
TAJD335(•)050	D	3.3	1.7	6	1.8
TAJD475(•)050	D	4.7	2.4	6	1.5
TAJD685(•)050	D	6.8	3.4	6	1.5
TAJE685(•)050	E	6.8	3.4	6	1.0
TAJE106(•)050	E	10	5.0	6	1.0

For 10% tolerance, insert 'K' in (•) above.
For 20% tolerance, insert 'M' in (•) above.
NOTE: Voltage ratings are minimum values. We reserve the right to supply higher voltage ratings in the same case size, to the same reliability standards.

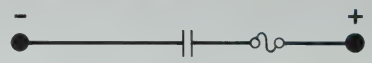
Marking (see page 6)

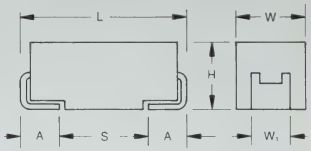
TAS Series — FUSEGUARD — Fused Tantalum Chip

The TAS fused tantalum capacitor is a derivative of the TAJ capacitor. It has the same physical size and footprint of the TAJ range of capacitors which allows it to be used as a direct replacement for the TAJ where the circuit function would benefit by having a fused element.

The fuse is contained within the resin molding of the capacitor assembly and has a typical fuse rating of 2 amps at 1 second. Once activated it has a high open circuit resistance of greater than 10 M ohms, with an open circuit break down voltage of 200 vdc.

Electrical Schematic





Case Dimensions inches (millimeters)

Code	EIA Code	L±0.008 (0.2)	W+0.008 (0.2) -0.004 (0.1)	H±.008 (0.2) -.004 (0.1)	W_1±0.008 (0.2)	A+0.012 (0.3) -.002 (0.2)	S Min.
C	6032	0.236 (6.0)	0.126 (3.2)	0.102 (2.6)	0.087 (2.2)	0.051 (1.3)	0.114 (2.9)
D	7343	0.287 (7.3)	0.169 (4.3)	0.114 (2.9)	0.094 (2.4)	0.051 (1.3)	0.173 (4.4)
E	7343H	0.287 (7.3)	0.169 (4.3)	0.162 (4.1)	0.094 (2.4)	0.051 (1.3)	0.173 (4.4)

W_1 dimension applies to the termination width for A dimensional area only.
Pad Stand-off is 0.1±0.1.

How to Order:

TAS	D	226	M	020	R	**

Type

Case Code
(See table above)

Capacitance Code
pF code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow)

Tolerance
K=±10%, M=±20%, (J=±5%, consult factory for details)

Rated DC Voltage

Packaging
(Consult page 13 for details)

Additional characters may be added for special requirements

Capacitance and Voltage Range (letter denotes case code)

Capacitance µF	Code	Rated voltage DC (V_R) 6.3V	10V	16V	20V	25V	35V	50V
0.1	104							
0.15	154							
0.22	224							
0.33	334							
0.47	474							
0.68	684							
1.0	105							C
1.5	155						C	C
2.2	225						C	D
3.3	335						C	D
4.7	475					C	D	E
6.8	685				C		D	
10	106			C	C	D	E	
15	156			C		D	E	
22	226		C	D	D	E		
33	336	C		D	E			
47	476		D	E				
68	686	D	E					
100	107	E						

Values in case codes not printed may be available on request.

Ratings and Part Number Reference

AVX Part No.	Case Size	Capacitance µF	DCL (µA) Max.	DF % Max.	ESR max. (Ω) @ 100 kHz
6.3 volts @ 85°C (4 volt @ 125°C)					
TASC336(•)006	C	33	2.1	6	2.2
TASD686(•)006	D	68	4.3	6	1.5
TASE107(•)006	E	100	6.3	6	1.0
10 volts @ 85°C (6.3 volt @ 125°C)					
TASC226(•)010	C	22	2.2	6	2.2
TASD476(•)010	D	47	4.7	6	1.5
TASE686(•)010	E	68	6.8	6	1.0
16 volts @ 85°C (10 volt @ 125°C)					
TASC106(•)016	C	10	1.6	6	2.5
TASC156(•)016	C	15	2.4	6	2.2
TASD226(•)016	D	22	3.5	6	1.8
TASD336(•)016	D	33	5.3	6	1.5
TASE476(•)016	E	47	7.5	6	1.0
20 volts @ 85°C (13 volt @ 125°C)					
TASC685(•)020	C	6.8	1.4	6	2.5
TASC106(•)020	C	10	2.0	6	2.2
TASD226(•)020	D	22	4.4	6	1.5
TASE336(•)020	E	33	6.6	6	1.0

AVX Part No.	Case Size	Capacitance µF	DCL (µA) Max.	DF % Max.	ESR max. (Ω) @ 100 kHz
25 volts @ 85°C (16 volt @ 125°C)					
TASC475(•)025	C	4.7	1.2	6	3.0
TASC685(•)025	C	6.8	1.7	6	2.5
TASD106(•)025	D	10	2.5	6	2.0
TASD156(•)025	D	15	3.8	6	1.5
TASE226(•)025	E	22	5.5	6	1.0
35 volts @ 85°C (23 volt @ 125°C)					
TASC155(•)035	C	1.5	0.5	6	3.5
TASC225(•)035	C	2.2	0.8	6	3.5
TASC335(•)035	C	3.3	1.2	6	3.0
TASD475(•)035	D	4.7	1.6	6	1.5
TASD685(•)035	D	6.8	2.4	6	1.5
TASE106(•)035	E	10	3.5	6	1.0
TASE156(•)035	E	15	5.3	6	1.0
50 volts @ 85°C (33 volt @ 125°C)					
TASC105(•)050	C	1.0	0.5	4	6.0
TASC155(•)050	C	1.5	0.8	6	5.0
TASD225(•)050	D	2.2	1.1	6	2.5
TASD335(•)050	D	3.3	1.7	6	2.0
TASE475(•)050	E	4.7	2.4	6	1.5

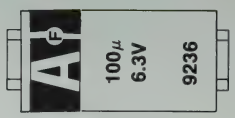
For 10% tolerance, insert "K" in (•) above.
For 20% tolerance, insert "M" in (•) above.
NOTE: Voltage ratings are minimum values. We reserve the right to supply higher voltage ratings in the same case size, to the same reliability standards.

Marking (see page 6)

Marking: TAS Series

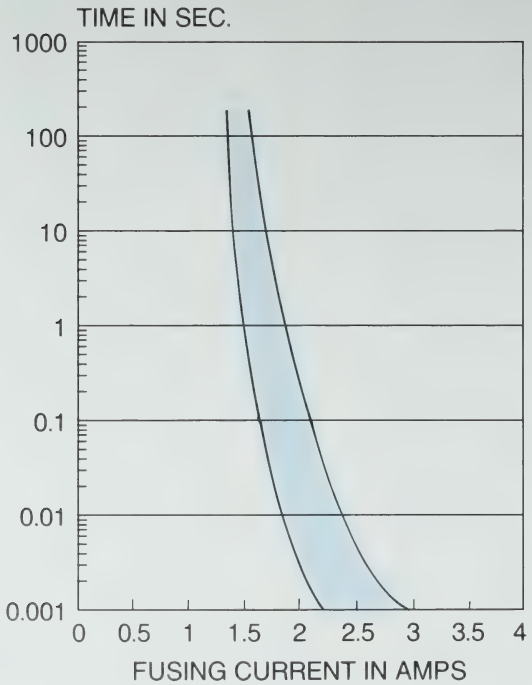
For TAS, the positive end of body has videcon readable polarity bar marking, with the AVX logo "A" as shown in the diagram. Bodies are marked by indelible laser marking on top surface with capacitance value, voltage and date of manufacture.

For TAS an "F" is also incorporated in the polarity bar to designate a 'fused' device.



C, D and E Case:
Capacitance in µF
Rated Voltage
at 85°C
Date Code

Typical Fusing Characteristics



Consult AVX for specific applications.

Tape and Reel Packaging

Solid Tantalum Chip TAJ and TAS

Tape and reel packaging for automatic component placement.
Please enter required Suffix on order. Loose products supplied on request.

TAJ and TAS Taping Suffix Table

Case size reference	Tape width mm	P mm	7" (180mm) reel Suffix	7" (180mm) reel Qty.	13" (330mm) reel Suffix	13" (330mm) reel Qty.
A	8	4	R	2000	S	8000
B	8	4	R	2000	S	8000
C	12	8	R	500	S	3000
D	12	8	R	500	S	2500
E	12	8	R	400	S	1500
M	12	4	R	1500	S	5000
N	12	8	R	500	S	2500
R	8	4	R	2500	S	10000
S	8	4	R	2500	S	10000
T	8	4	R	2500	S	10000

Tape Specification

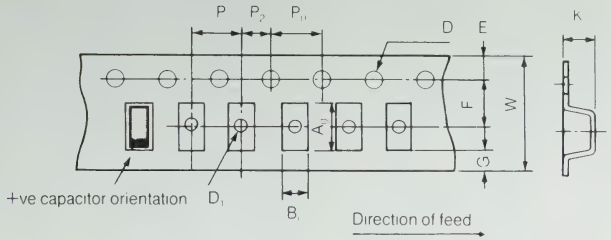
Tape dimensions comply to EIA RS 481 A

Dimensions A_0 and B_0 of the pocket and the tape thickness, K, are dependent on the component size.

Tape materials do not affect component solderability during storage.

Carrier Tape Thickness <0.4mm

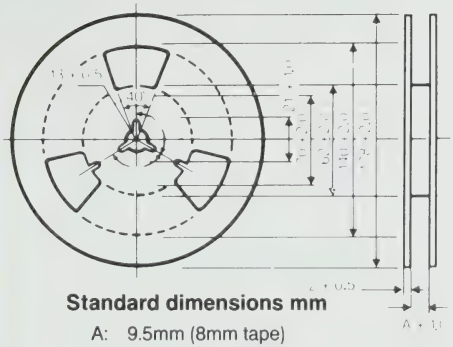
Total Tape Thickness — K max	
TAJ/TAS	
Case size reference	Dims
A	0.090 (2.3)
B	0.102 (2.6)
C	0.130 (3.3)
D	0.142 (3.6)
E	0.189 (4.8)
M	0.110 (2.8)
N	0.157 (4.0)
R	0.075 (1.9)
S	0.075 (1.9)
T	0.075 (1.9)



Code	8mm Tape		12mm Tape	
P*	0.157±0.004 or 0.315±0.004	(4±0.1) (8±0.1)	0.157±0.004 or 0.315±0.004	(4±0.1) (8±0.1)
G	0.03 min	1.75 min	0.03 min	1.75 min
F	0.138±0.002	3.5±0.05	0.22±0.002	5.5±0.05
E	0.069±0.004	1.75±0.1	0.069±0.004	1.75±0.1
W	0.315±0.012	8±0.3	0.472±0.012	12±0.3
P_2	0.079±0.002	2±0.05	0.079±0.002	2±0.05
P_0	0.157±0.004	4±0.1	0.157±0.004	4±0.1
D	0.059±0.004 -0	1.5±0.1 -0	0.059±0.004 -0	1.5±0.1 -0
D_1	0.039 min	1.0 min	0.059 min	1.5 min

*See taping suffix tables for actual P dimension (component pitch).

Plastic Tape Reel Dimensions



Standard dimensions mm

A: 9.5mm (8mm tape)
13.0mm (12mm tape)

Cover Tape Dimensions
Thickness: 75±25μ
Width of tape:
5.5mm + 0.2mm (8mm tape)
9.5mm + 0.2mm (12mm tape)

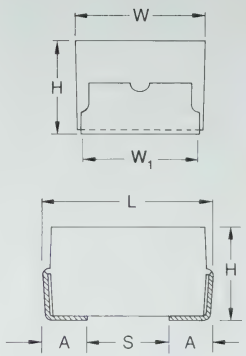
Microminiature Surface Mount Technology
Solid Tantalum Chip Capacitors

The TAZ Chip Series is fully molded and designed for use in surface mount applications utilizing either solder, conductive epoxy adhesive or thermal-compression bonding techniques. It is compatible with the CWR06 and EIA SOCM-2513 through 7238 pad layouts.

Each TAZ Series Chip is clearly marked with the capacitance value, voltage, and a videcon readable polarity indicator.

The standard termination finish is electroplated fused solder over a nickel plated copper alloy lead material. Gold-plated and hot solder dip terminations are also available.

The molded encapsulant has been carefully selected to meet the flammability requirements of UL94V-0 and also exceeds the vacuum stability requirements of the NASA SP-R-0022A specification. The TAZ is fully qualified to MIL-C-55365/4 as style CWR09. (See page 20.)



Case Dimensions inches (millimeters)

Case Code	Length L±0.015 (.38)	Width W±0.015 (.38)	Height H±0.015 (.38)	Term. Width W_1 ±0.005 (.13)	Term. Length A±0.005 (.13)	"S" Min
"Regular"						
A	0.100 (2.54)	0.050 (1.27)	0.050 (1.27)	0.050 (1.27)	0.030 (.76)	0.015 (.38)
B	0.150 (3.81)	0.050 (1.27)	0.050 (1.27)	0.050 (1.27)	0.030 (.76)	0.065 (1.65)
C	0.200 (5.08)	0.050 (1.27)	0.050 (1.27)	0.050 (1.27)	0.030 (.76)	0.115 (2.92)
D	0.150 (3.81)	0.100 (2.54)	0.050 (1.27)	0.095 (2.41)	0.030 (.76)	0.065 (1.65)
E	0.200 (5.08)	0.100 (2.54)	0.050 (1.27)	0.095 (2.41)	0.030 (.76)	0.115 (2.92)
F	0.220 (5.59)	0.135 (3.43)	0.070 (1.78)	0.130 (3.30)	0.030 (.76)	0.135 (3.43)
G	0.265 (6.73)	0.110 (2.79)	0.110 (2.79)	0.105 (2.67)	0.050 (1.27)	0.140 (3.56)
H	0.285 (7.24)	0.150 (3.81)	0.110 (2.79)	0.145 (3.68)	0.050 (1.27)	0.160 (4.06)
"Special"						
R	0.087 MAX (2.2)	0.057 MAX (1.5)	0.047 MAX (1.2)	0.047 (1.2)	0.016 (0.4)	0.043 (1.1)
X	0.285 MAX (7.2)	0.220 MAX (6.1)	0.115 MAX (2.8)	0.120 (3.05)	0.050 (1.27)	N/A

NOTE: For solder coated terminations add 0.015 (0.38) max. to length and height dimensions.

TAZ Series

How to Order: (professional grade)

TAZ	D	335	M	015	C	R*

Type

Case Code
(See table on page 14)

Capacitance Code
pF code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow)

Tolerance
(J=±5%, K=±10%, M=±20%)

Rated DC Voltage

Lead Configuration
(C=Chip)

Packaging
(Consult page 25 for details)

*Note: Other digits will be added by factory to identify specific customer requirements including termination finish. Contact factory for details.

Technical Data:		All technical data relate to an ambient temperature of +25°C							
Capacitance Range:		0.1 µF to 330 µF							
Capacitance Tolerance:		±20%; ±10%; ±5%							
Rated Voltage DC (V_R)	≦+85°C:	4	6	10	15	20	25	35	50
Category Voltage (V_C)	≦+125°C:	2.7	4	7	10	13	17	23	33
Surge Voltage (V_S)	≦+85°C:	5.2	8	13	20	26	33	46	65
	≦+125°C:	3.5	5	9	12	16	21	28	40
Temperature Range:		-55°C to +125°C							
Dissipation Factor:		see part number table							
Reverse Voltage Max:		10% V_R @ 25°C to a maximum of 1 volt							
		3% V_R @ 85°C to a maximum of 1 volt							
		1% V_R @ 125°C to a maximum of 1 volt							

Marking

The positive end of body has videcon readable polarity bar marking along with the capacitance code and rated working voltage:

- Polarity
- Capacitance
- Voltage

Typical Lead Frame Material Thicknesses

Lead Frame: Alloy 194
Thickness: .005±.0002"

Fused Solder Plate: (60/40)
60-135 microinches nickel
300±75 microinches fused solder

Gold Plated:
35-100 microinches nickel
50-75 microinches gold

Hot Solder Dipped: (60/40)
50-100 microinches nickel
Min. 60 microinches solder

Standard Range Series

Capacitance Range (letter denotes case code)

Capacitance		Rated voltage DC (V_R)							
µF	Code	4V	6V	10V	15V	20V	25V	35V	50V
0.1	104								A
0.15	154								A
0.22	224							A	B
0.33	334						A		B
0.47	474					A		B	C
0.68	684				A	B	B	C	D
1.0	105			A		B	C	D	E
1.5	155		A		B	C	D	E	F
2.2	225	A		B	C	D	E		F
3.3	335		B	C	D	E		F	G
4.7	475	B	C	D	E		F	G	H
6.8	685	C	D	E		F	G	H	
10	106	D	E		F		G		
15	156	E		F		G	H		
22	226		F		G	H			
33	336	F		G	H				
47	476		G	H					
68	686	G	H						
100	107	H							

TAZ Series

Extended Range Series

Rated Voltage DC (V_R) @ 85°C

Capacitance µF	Code	4V	6V	10V	15V	20V	25V	35V	50V
0.22	224								A
0.33	334							A	
0.47	474						A		
0.68	684					A		B	C
1.0	105				A		B	C/D	
1.5	155				A	B		C/D	
2.2	225			A			C/D	E	
3.3	335		A		B	C	D		
4.7	475	A		B	C/D	E		F	G
6.8	685		B	C/D	E		F	G	H
10	106		B	C/D		F		H	
15	156	B		E		F	G		
22	226	C/D	E		F				
33	336		E	F		G	H		
47	476	E		F	G	H			
68	686		F	G	H				
100	107	F		G	H				
150	157		G	H					
220	227	G	H						
330	337	H							

Not available as CWR09 Military

Special Case Sizes

Rated Voltage DC (V_R) @ 85°C

Capacitance µF	Code	2V	4V	6V	10V	15V	20V	25V	35V	50V
0.10	104						R			
0.15	154						R			
0.22	224						R			
0.33	334						R			
0.47	474						R			
0.68	684					R				
1.0	105				R	R				
1.5	155			R	R					
2.2	225		R	R						
3.3	335		R	R						
4.7	475	R	R							
6.8	685	R								
10	106									X
15	156									
22	226								X	
33	336							X		
47	476									
68	686						X			
100	107					X				
150	157				X					
220	227			X						
330	337		X							

Not available as CWR09 Military

Ratings and Part Number Reference

AVX Part No.	Case Size	Capacitance µF	DCL (µA) Max.	DF % Max.	ESR max. (Ω) @ 100 kHz
4 volt @ 85°C (2.5 volt @ 125°C)					
TAZA225(‡)004C*	A	2.2	1.0	6	20.0
TAZA475(‡)004C*	A	4.7	1.0	6	10.0
TAZB475(‡)004C*	B	4.7	1.0	6	10.0
TAZC685(‡)004C*	C	6.8	1.0	6	10.0
TAZD106(‡)004C*	D	10.0	1.0	6	10.0
TAZB156(‡)004C*	B	15.0	1.0	6	5.0
TAZE156(‡)004C*	E	15.0	1.0	8	5.0
TAZC226(‡)004C*	C	22.0	1.0	8	5.0
TAZD226(‡)004C*	D	22.0	1.0	8	5.0
TAZF336(‡)004C*	F	33.0	2.0	8	4.0
TAZE476(‡)004C*	E	47.0	2.0	8	4.0
TAZG686(‡)004C*	G	68.0	3.0	10	2.0
TAZF107(‡)004C*	F	100.0	3.0	10	2.0
TAZH107(‡)004C*	H	100.0	4.0	10	1.0
TAZG227(‡)004C*	G	220.0	6.0	10	1.0
TAZH337(‡)004C*	H	330.0	8.0	10	1.0
6 volt @ 85°C (4 volt @ 125°C)					
TAZA155(‡)006C*	A	1.5	1.0	6	12.0
TAZA335(‡)006C*	A	3.3	1.0	6	12.0
TAZB335(‡)006C*	B	3.3	1.0	6	12.0
TAZC475(‡)006C*	C	4.7	1.0	6	12.0
TAZB685(‡)006C*	B	6.8	1.0	6	12.0
TAZD685(‡)006C*	D	6.8	1.0	6	12.0
TAZB106(‡)006C*	B	10.0	1.0	6	6.0
TAZE226(‡)006C*	E	22.0	2.0	6	4.0
TAZF226(‡)006C*	F	22.0	2.0	8	4.0
TAZE336(‡)006C*	E	33.0	3.0	8	3.0
TAZG476(‡)006C*	G	47.0	3.0	10	2.0
TAZF686(‡)006C*	F	68.0	3.0	10	2.0
TAZH686(‡)006C*	H	68.0	4.0	10	2.0
TAZG157(‡)006C*	G	150.0	6.0	10	2.0
TAZH227(‡)006C*	H	220.0	10.0	10	1.0
10 volt @ 85°C (6.3 volt @ 125°C)					
TAZA105(‡)010C*	A	1.0	1.0	6	18.0
TAZA225(‡)010C*	A	2.2	1.0	6	12.0
TAZB225(‡)010C*	B	2.2	1.0	6	12.0
TAZC335(‡)010C*	C	3.3	1.0	6	12.0
TAZB475(‡)010C*	B	4.7	1.0	6	10.0
TAZD475(‡)010C*	D	4.7	1.0	6	10.0
TAZC685(‡)010C*	C	6.8	1.0	6	4.0
TAZD685(‡)010C*	D	6.8	1.0	6	4.0
TAZC106(‡)010C*	C	10.0	1.0	6	4.0
TAZD106(‡)010C*	D	10.0	1.0	6	4.0
TAZE156(‡)010C*	E	15.0	2.0	6	3.0
TAZF156(‡)010C*	F	15.0	2.0	6	3.0
TAZF336(‡)010C*	F	33.0	3.0	6	3.0
TAZG336(‡)010C*	G	33.0	3.0	10	3.0
TAZF476(‡)010C*	F	47.0	3.0	10	3.0
TAZH476(‡)010C*	H	47.0	5.0	10	2.0
TAZG686(‡)010C*	G	68.0	6.0	10	2.0
TAZG107(‡)010C*	G	100.0	10.0	10	1.0
TAZH157(‡)010C*	H	150.0	10.0	10	1.0

AVX Part No.	Case Size	Capacitance µF	DCL (µA) Max.	DF % Max.	ESR max. (Ω) @ 100 kHz
15 volt @ 85°C (10 volt @ 125°C)					
TAZA684(‡)015C*	A	0.68	1.0	6	22.0
TAZA105(‡)015C*	A	1.0	1.0	6	15.0
TAZA155(‡)015C*	A	1.5	1.0	6	15.0
TAZB155(‡)015C*	B	1.5	1.0	6	15.0
TAZC225(‡)015C*	C	2.2	1.0	6	12.0
TAZB335(‡)015C*	B	3.3	1.0	6	10.0
TAZD335(‡)015C*	D	3.3	1.0	6	10.0
TAZC475(‡)015C*	C	4.7	1.0	6	8.0
TAZD475(‡)015C*	D	4.7	1.0	6	6.0
TAZE475(‡)015C*	E	4.7	1.0	6	6.0
TAZE685(‡)015C*	E	6.8	2.0	6	4.0
TAZF106(‡)015C*	F	10.0	2.0	6	5.0
TAZF226(‡)015C*	F	22.0	3.0	6	3.0
TAZG226(‡)015C*	G	22.0	4.0	8	3.0
TAZH336(‡)015C*	H	33.0	5.0	8	2.0
TAZG476(‡)015C*	G	47.0	6.0	8	2.0
TAZH686(‡)015C*	H	68.0	10.0	8	1.0
TAZH107(‡)015C*	H	100.0	10.0	8	1.0
20 volt @ 85°C (13 volt @ 125°C)					
TAZA474(‡)020C*	A	0.47	1.0	6	20.0
TAZA684(‡)020C*	A	0.68	1.0	6	15.0
TAZB684(‡)020C*	B	0.68	1.0	6	15.0
TAZB105(‡)020C*	B	1.0	1.0	6	15.0
TAZB155(‡)020C*	B	1.5	1.0	6	10.0
TAZC155(‡)020C*	C	1.5	1.0	6	10.0
TAZD225(‡)020C*	D	2.2	1.0	6	10.0
TAZC335(‡)020C*	C	3.3	1.0	6	8.0
TAZD335(‡)020C*	D	3.3	1.0	6	8.0
TAZE335(‡)020C*	E	3.3	1.0	6	8.0
TAZE475(‡)020C*	E	4.7	1.0	6	6.0
TAZF685(‡)020C*	F	6.8	2.0	6	5.0
TAZF106(‡)020C*	F	10.0	2.0	6	4.0
TAZF156(‡)020C*	F	15.0	2.0	6	4.0
TAZG156(‡)020C*	G	15.0	3.0	6	3.0
TAZH226(‡)020C*	H	22.0	4.0	6	2.0
TAZG336(‡)020C*	G	33.0	8.0	6	2.0
TAZH476(‡)020C*	H	47.0	10.0	6	1.0

‡ Insert J for ± 5% tolerance, K for ± 10%, M for ± 20%

* Insert letter for packing option. See ordering information on page 25.

All technical data relates to an ambient temperature of +25°C measured at 120Hz 0.5V RMS unless otherwise stated.

For any special electrical requirements, please contact factory.

Ratings and Part Number Reference

AVX Part No.	Case Size	Capacitance µF	DCL (µA) Max.	DF % Max.	ESR max. (Ω) @ 100 kHz
25 volt @ 85°C (16 volt @ 125°C)					
TAZA334(‡)025C*	A	0.33	1.0	6	25.0
TAZA474(‡)025C*	A	0.47	1.0	6	18.0
TAZB684(‡)025C*	B	0.68	1.0	6	15.0
TAZB105(‡)025C*	B	1.0	1.0	6	10.0
TAZC105(‡)025C*	C	1.0	1.0	6	12.0
TAZC155(‡)025C*	C	1.5	2.0	6	8.0
TAZD155(‡)025C*	D	1.5	1.0	6	10.0
TAZC225(‡)025C*	C	2.2	1.0	6	8.0
TAZD225(‡)025C*	D	2.2	1.0	6	8.0
TAZE225(‡)025C*	E	2.2	1.0	6	8.0
TAZD335(‡)025C*	D	3.3	1.0	6	8.0
TAZF475(‡)025C*	F	4.7	2.0	6	6.0
TAZF685(‡)025C*	F	6.8	2.0	6	4.0
TAZG685(‡)025C*	G	6.8	2.0	6	4.0
TAZG106(‡)025C*	G	10.0	3.0	6	3.0
TAZG156(‡)025C*	G	15.0	4.0	6	2.0
TAZH156(‡)025C*	H	15.0	4.0	6	2.0
TAZH336(‡)025C*	H	33.0	6.0	6	1.0
35 volt @ 85°C (23 volt @ 125°C)					
TAZA224(‡)035C*	A	0.22	1.0	6	25.0
TAZA334(‡)035C*	A	0.33	1.0	6	25.0
TAZB474(‡)035C*	B	0.47	1.0	6	20.0
TAZB684(‡)035C*	B	0.68	1.0	6	10.0
TAZC684(‡)035C*	C	0.68	1.0	6	15.0
TAZC105(‡)035C*	D	1.0	1.0	6	8.0
TAZD105(‡)035C*	D	1.0	1.0	6	12.0
TAZC155(‡)035C*	C	1.5	1.0	6	10.0
TAZD155(‡)035C*	D	1.5	1.0	6	6.0
TAZE155(‡)035C*	E	1.5	1.0	6	6.0
TAZE225(‡)035C*	E	2.2	1.0	6	6.0
TAZF335(‡)035C*	F	3.3	1.0	6	6.0
TAZF475(‡)035C*	F	4.7	1.0	6	6.0
TAZG475(‡)035C*	G	4.7	2.0	6	3.0
TAZG685(‡)035C*	G	6.8	3.0	6	2.0
TAZH685(‡)035C*	H	6.8	3.0	6	3.0
TAZH106(‡)035C*	H	10.0	4.0	6	1.0
50 volt @ 85°C (33 volt @ 125°C)					
TAZA104(‡)050C*	A	0.10	1.0	6	30.0
TAZA154(‡)050C*	A	0.15	1.0	6	30.0
TAZA224(‡)050C*	A	0.22	1.0	6	30.0
TAZB224(‡)050C*	B	0.22	1.0	6	25.0
TAZB334(‡)050C*	B	0.33	1.0	6	25.0
TAZC474(‡)050C*	C	0.47	1.0	6	20.0
TAZC684(‡)050C*	C	0.68	1.0	6	20.0
TAZD684(‡)050C*	D	0.68	1.0	6	20.0
TAZE105(‡)050C*	E	1.0	1.0	6	12.0
TAZF155(‡)050C*	F	1.5	1.0	6	10.0
TAZF225(‡)050C*	F	2.2	2.0	6	6.0
TAZG335(‡)050C*	G	3.3	2.0	6	4.0
TAZG475(‡)050C*	G	4.7	3.0	6	3.0
TAZH475(‡)050C*	H	4.7	3.0	6	2.0
TAZH685(‡)050C*	H	6.8	4.0	6	1.0

Special Case Sizes Part Number Reference

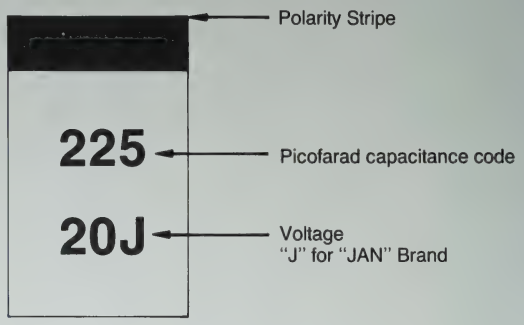
AVX Part No.	Case Size	Capacitance µF	DCL (µA) Max.	DF % Max.
2 volt @ 85°C (1.3 volt @ 125°C)				
TAZR475(‡)002C*	R	4.7	0.5	6
TAZR685(‡)002C*	R	6.8	0.5	6
4 volt @ 85°C (2.5 volt @ 125°C)				
TAZR225(‡)004C*	R	2.2	0.5	6
TAZR335(‡)004C*	R	3.3	0.5	6
TAZR475(‡)004C*	R	4.7	0.5	6
TAZX337(‡)004C*	X	330.0	12	8
6 volt @ 85°C (4 volt @ 125°C)				
TAZR155(‡)006C*	R	1.5	0.5	6
TAZR225(‡)006C*	R	2.2	0.5	6
TAZR335(‡)006C*	R	3.3	0.5	6
TAZX227(‡)006C*	X	220.0	12	8
10 volt @ 85°C (6.3 volt @ 125°C)				
TAZR105(‡)010C*	R	1.0	0.5	6
TAZR155(‡)010C*	R	1.5	0.5	6
TAZX157(‡)010C*	X	150.0	12	8
15 volt @ 85°C (10 volt @ 125°C)				
TAZR684(‡)015C*	R	0.68	0.5	6
TAZR105(‡)015C*	R	1.0	0.5	6
TAZX107(‡)015C*	X	100.0	12	8
20 volt @ 85°C (13 volt @ 125°C)				
TAZR104(‡)020C*	R	0.1	0.5	6
TAZR154(‡)020C*	R	0.15	0.5	6
TAZR224(‡)020C*	R	0.22	0.5	6
TAZR334(‡)020C*	R	0.33	0.5	6
TAZR684(‡)020C*	R	0.68	0.5	6
TAZX686(‡)020C*	X	68.0	12	6
25 volt @ 85°C (16 volt @ 125°C)				
TAZX336(‡)025C*	X	33.0	8.5	6
35 volt @ 85°C (23 volt @ 125°C)				
TAZX226(‡)035C*	X	22.0	8	6
50 volt @ 85°C (33 volt @ 125°C)				
TAZX106(‡)050C*	X	10.0	5	6

‡ Insert J for ± 5% tolerance, K for ± 10%, M for ± 20%
* Insert letter for packing option. See ordering information on page 25.
All technical data relates to an ambient temperature of +25°C measured at 120Hz 0.5V RMS unless otherwise stated.
For any special electrical requirements, please contact factory.

TAZ Military Series MIL-C-55365 (Rev. C) (CWR09 Style)

Marking (military qualified)

The "V" following rated voltage is replaced with a "J" for JAN Brand.



How to Order:

(MIL-C-55365/4) **CWR09** **J** **B** **225** **J** **M**

Style

Voltage
C=4, D=6, F=10, H=15,
J=20, K=25, M=35, N=50

Termination Finish
B=Gold Plated, C=Hot Solder Dipped,
K=Solder Fused

Capacitance Code

Tolerance
(J=±5%, K=±10%, M=±20%)

Failure Rate
Exponential: (M=1%/1000 hours); (P=0.1%/1000 hours)
Weibull: (B=0.1%/1000 hours); (C=0.01%/1000 hours)

NOTE: CWR09 is fully interchangeable with CWR06.

TAZ Military Series MIL-C-55365 (Rev. C) (CWR09 Style)

Electrical Ratings for CWR09 Capacitors

MIL-C-55365/4 Part Number (See Note 1)	Case Size	Rated voltage (85°C) (volts)	Capacitance (nom.) (μF)	DC Leakage (max.)			Dissipation Factor (max.)		
				+25°C (μA)	+85°C (μA)	+125°C (μA)	+25°C (%)	+85/125°C (%)	-55°C (%)
CWR09C•225†@	A	4	2.2	1.0	10	12	6	8	8
CWR09C•475†@	B	4	4.7	1.0	10	12	6	8	8
CWR09C•685†@	C	4	6.8	1.0	10	12	6	8	8
CWR09C•106†@	D	4	10.0	1.0	10	12	8	8	10
CWR09C•156†@	E	4	15.0	1.0	10	12	8	10	12
CWR09C•336†@	F	4	33.0	2.0	20	24	8	10	12
CWR09C•686†@	G	4	68.0	3.0	30	36	10	12	12
CWR09C•107†@	H	4	100.0	4.0	40	48	10	12	12
CWR09D•155†@	A	6	1.5	1.0	10	12	6	8	8
CWR09D•335†@	B	6	3.3	1.0	10	12	6	8	8
CWR09D•475†@	C	6	4.7	1.0	10	12	6	8	8
CWR09D•685†@	D	6	6.8	1.0	10	12	6	8	8
CWR09D•106†@	E	6	10.0	1.0	10	12	8	10	12
CWR09D•226†@	F	6	22.0	2.0	20	24	8	10	12
CWR09D•476†@	G	6	47.0	3.0	30	36	10	12	12
CWR09D•686†@	H	6	68.0	4.0	40	48	10	12	12
CWR09F•105†@	A	10	1.0	1.0	10	12	6	8	8
CWR09F•225†@	B	10	2.2	1.0	10	12	6	8	8
CWR09F•335†@	C	10	3.3	1.0	10	12	6	8	8
CWR09F•475†@	D	10	4.7	1.0	10	12	6	8	8
CWR09F•685†@	E	10	6.8	1.0	10	12	6	8	8
CWR09F•156†@	F	10	15.0	2.0	20	24	8	8	10
CWR09F•336†@	G	10	33.0	3.0	30	36	10	12	12
CWR09F•476†@	H	10	47.0	5.0	50	60	10	12	12
CWR09H•684†@	A	15	0.68	1.0	10	12	6	8	8
CWR09H•155†@	B	15	1.5	1.0	10	12	6	8	8
CWR09H•225†@	C	15	2.2	1.0	10	12	6	8	8
CWR09H•335†@	D	15	3.3	1.0	10	12	6	8	8
CWR09H•475†@	E	15	4.7	1.0	10	12	6	8	8
CWR09H•106†@	F	15	10.0	2.0	20	24	6	8	8
CWR09H•226†@	G	15	22.0	4.0	40	48	8	8	10
CWR09H•336†@	H	15	33.0	5.0	50	60	8	8	10
CWR09J•474†@	A	20	0.47	1.0	10	12	6	8	8
CWR09J•684†@	B	20	0.68	1.0	10	12	6	8	8
CWR09J•105†@	B	20	1.0	1.0	10	12	6	8	8
CWR09J•155†@	C	20	1.5	1.0	10	12	6	8	8
CWR09J•225†@	D	20	2.2	1.0	10	12	6	8	8
CWR09J•335†@	E	20	3.3	1.0	10	12	6	8	8
CWR09J•685†@	F	20	6.8	2.0	20	24	6	8	8
CWR09J•156†@	G	20	15.0	3.0	30	36	6	8	8

Note 1: To complete the MIL-C-55365/4 Part Number, 3 pieces of information must be added:

• = Termination Finish Designator:
B = Gold Plated
C = Hot Solder Dipped
K = Solder Fused

† = Tolerance Code:
J = ±5%
K = ±10%
M = ±20%

@ = Failure Rate Level:
Exponential: M = 1.0% per 1000 hours
P = 0.1% per 1000 hours
Weibull: B = 0.1% per 1000 hours
C = 0.01% per 1000 hours

Contact factory for latest qualification status.

TAZ Military Series MIL-C-55365 (Rev. C) (CWR09 Style)

Electrical Ratings for CWR09 Capacitors

MIL-C-55365/4 Part Number (See Note 1)	Case Size	Rated voltage (85°C) (volts)	Capacitance (nom.) (μF)	DC Leakage (max.)			Dissipation Factor (max.)		
				+25°C (μA)	+85°C (μA)	+125°C (μA)	+25°C (%)	+85/125°C (%)	-55°C (%)
CWR09J•226†@	H	20	22.0	4.0	40	48	6	8	8
CWR09K•334†@	A	25	0.33	1.0	10	12	6	8	8
CWR09K•684†@	B	25	0.68	1.0	10	12	6	8	8
CWR09K•105†@	C	25	1.0	1.0	10	12	6	8	8
CWR09K•155†@	D	25	1.5	1.0	10	12	6	8	8
CWR09K•255†@	E	25	2.2	1.0	10	12	6	8	8
CWR09K•475†@	F	25	4.7	2.0	20	24	6	8	8
CWR09K•685†@	G	25	6.8	2.0	20	24	6	8	8
CWR09K•106†@	G	25	10.0	3.0	30	36	6	8	8
CWR09K•156†@	H	25	15.0	4.0	40	48	6	8	8
CWR09M•224†@	A	35	0.22	1.0	10	12	6	8	8
CWR09M•474†@	B	35	0.47	1.0	10	12	6	8	8
CWR09M•684†@	C	35	0.68	1.0	10	12	6	8	8
CWR09M•105†@	D	35	1.0	1.0	10	12	6	8	8
CWR09M•155†@	E	35	1.5	1.0	10	12	6	8	8
CWR09M•335†@	F	35	3.3	1.0	10	12	6	8	8
CWR09M•475†@	G	35	4.7	2.0	20	24	6	8	8
CWR09M•685†@	H	35	6.8	3.0	30	36	6	8	8
CWR09N•104†@	A	50	0.10	1.0	10	12	6	8	8
CWR09N•154†@	A	50	0.15	1.0	10	12	6	8	8
CWR09N•224†@	B	50	0.22	1.0	10	12	6	8	8
CWR09N•334†@	B	50	0.33	1.0	10	12	6	8	8
CWR09N•474†@	C	50	0.47	1.0	10	12	6	8	8
CWR09N•684†@	D	50	0.68	1.0	10	12	6	8	8
CWR09N•105†@	E	50	1.0	1.0	10	12	6	8	8
CWR09N•155†@	F	50	1.5	1.0	10	12	6	8	8
CWR09N•225†@	F	50	2.2	2.0	20	24	6	8	8
CWR09N•335†@	G	50	3.3	2.0	20	24	6	8	8
CWR09N•475†@	H	50	4.7	3.0	30	36	6	8	8

Note 1: To complete the MIL-C-55365/4 Part Number, 3 pieces of information must be added:

• = Termination Finish Designator:
B = Gold Plated
C = Hot Solder Dipped
K = Solder Fused

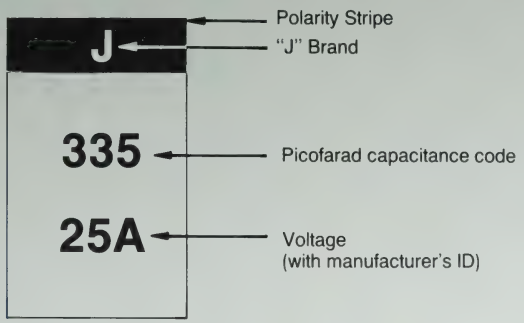
† = Tolerance Code:
J = ±5%
K = ±10%
M = ±20%

@ = Failure Rate Level:
Exponential: M = 1.0% per 1000 hours
P = 0.1% per 1000 hours
Weibull: B = 0.1% per 1000 hours
C = 0.01% per 1000 hours

Contact factory for latest qualification status.

TAZ Military Series MIL-C-55365 (Rev. C) (CWR11 Style)

MIL-C-55365/8 Marking (CWR11 style)



How to Order:
(MIL-C-55365/8)

CWR11 J B 225 K M

Style

Voltage
D=6, F=10, H=15, J=20
K=25, M=35, N=50

Termination Finish
B=Gold Plated
C=Hot Solder Dipped
K=Solder Fused

Capacitance Code

Tolerance
(J=±5%, K=±10%, M=±20%)

Failure Rate
M=1.0% per 1000 hours
P=0.1% per 1000 hours

Electrical Ratings for CWR11 Capacitors

MIL-C-55365/8 Part Number	Case Size	Rated voltage (85°C) (volts)	Capacitance (nom.) (μF)	DC Leakage (max.)			Dissipation Factor (max.)			Max ESR 100 kHz (Ω)
				+25°C (μA)	+85°C (μA)	+125°C (μA)	+25°C (%)	+85/125°C (%)	-55°C (%)	
CWR11D*225†@	A	6	2.2	0.5	5.0	6.0	6	6	8	15.6
CWR11D*685†@	B	6	6.8	0.5	5.0	6.0	6	6	8	4.5
CWR11D*156†@	C	6	15	0.9	9.0	10.8	6	6	8	3.0
CWR11D*476†@	D	6	47	2.8	28.0	33.6	6	6	8	1.8
CWR11F*155†@	A	10	1.5	0.5	5.0	6.0	6	6	8	15.0
CWR11F*475†@	B	10	4.7	0.5	5.0	6.0	6	6	8	4.5
CWR11F*156†@	C	10	15	1.5	15.0	18.0	6	6	8	2.5
CWR11F*336†@	D	10	33	3.3	33.0	39.6	6	6	8	1.8
CWR11H*105†@	A	15	1.0	0.5	5.0	6.0	4	6	8	15.0
CWR11H*335†@	B	15	3.3	0.5	5.0	6.0	6	6	8	5.0
CWR11H*106†@	C	15	10	1.6	16.0	19.2	6	6	8	2.5
CWR11H*226†@	D	15	22	3.3	33.0	39.6	6	6	8	1.8
CWR11J*684†@	A	20	0.68	0.5	5.0	6.0	4	6	8	15.0
CWR11J*225†@	B	20	2.2	0.5	5.0	6.0	6	6	8	6.0
CWR11J*475†@	C	20	4.7	1.0	10.0	12.0	6	6	8	3.0
CWR11J*156†@	D	20	15	3.0	30.0	36.0	6	6	8	1.8
CWR11K*474†@	A	25	0.47	0.5	5.0	6.0	4	6	8	18.0
CWR11K*155†@	B	25	1.5	0.5	5.0	6.0	6	6	8	7.0
CWR11K*335†@	C	25	3.3	0.9	9.0	10.8	6	6	8	4.0
CWR11K*106†@	D	25	10	2.5	25.0	30.0	6	6	8	22.0
CWR11M*104†@	A	35	0.10	0.5	5.0	6.0	4	6	8	24.0
CWR11M*154†@	A	35	0.15	0.5	5.0	6.0	4	6	8	21.0
CWR11M*224†@	A	35	0.22	0.5	5.0	6.0	4	6	8	19.0
CWR11M*334†@	A	35	0.33	0.5	5.0	6.0	4	6	8	18.0
CWR11M*474†@	B	35	0.47	0.5	5.0	6.0	4	6	8	11.0
CWR11M*684†@	B	35	0.68	0.5	5.0	6.0	4	6	8	8.0
CWR11M*105†@	B	35	1.0	0.5	5.0	6.0	4	6	8	7.0
CWR11M*155†@	C	35	1.5	0.5	5.0	6.0	6	6	8	6.0
CWR11M*225†@	C	35	2.2	0.8	8.0	9.6	6	6	8	4.0
CWR11M*335†@	D	35	3.3	1.2	12.0	14.4	6	6	8	3.0
CWR11M*475†@	D	35	4.7	1.7	17.0	20.4	6	6	8	2.5
CWR11N*104†@	A	50	0.10	0.5	5.0	6.0	4	6	8	22.0
CWR11N*154†@	B	50	0.15	0.5	5.0	6.0	4	6	8	19.0
CWR11N*224†@	B	50	0.22	0.5	5.0	6.0	4	6	8	16.0
CWR11N*334†@	B	50	0.33	0.5	5.0	6.0	4	6	8	13.0
CWR11N*474†@	C	50	0.47	0.5	5.0	6.0	4	6	8	9.0
CWR11N*684†@	C	50	0.68	0.5	5.0	6.0	4	6	8	7.0
CWR11N*105†@	C	50	1.0	0.5	5.0	6.0	4	6	8	6.0
CWR11N*155†@	D	50	1.5	0.8	8.0	9.6	6	6	8	5.0
CWR11N*225†@	D	50	2.2	1.1	11.0	13.2	6	6	8	3.5

Note 1: To complete the MIL-C-55365/4 Part Number, 3 pieces of information must be added:

* = Termination Finish Designator:
  B = Gold Plated
  C = Hot Solder Dipped
  K = Solder Fused

† = Tolerance Code:
  J = ±5%
  K = ±10%
  M = ±20%

@ = Failure Rate Level:
  Exponential: M = 1.0% per 1000 hours
  P = 0.1% per 1000 hours
  Weibull: B = 0.1% per 1000 hours
  C = 0.01% per 1000 hours

Contact factory for latest qualification status.

Tape and Reel Packaging

Solid Tantalum Chip TAZ

Tape and reel packaging for automatic component placement.
Please enter required Suffix on order. Loose products supplied on request.

TAZ Taping Suffix Table

Case size reference	Tape width mm	P mm	7" (180mm) reel Suffix	7" (180mm) reel Qty.	13" (330mm) reel Suffix	13" (330mm) reel Qty.
R	8	4	R	2500	S	10000
A	8	4	R	2500	S	9000
B	12	4	R	2500	S	9000
C	12	4	R	2500	S	9000
D	12	4	R	2500	S	8000
E	12	4	R	2500	S	8000
F	12	8	R	1000	S	3000
G	12	8	R	500	S	2500
H	12	8	R	500	S	2500

Tape Specification

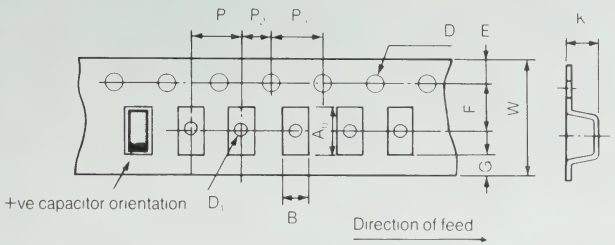
Tape dimensions comply to EIA RS 481 A

Dimensions A_0 and B_0 of the pocket and the tape thickness, K, are dependent on the component size.

Tape materials do not affect component solderability during storage.

Carrier Tape Thickness <0.4mm

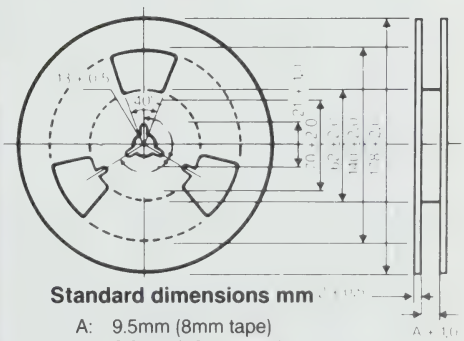
Total Tape Thickness — K max	
TAZ	
Case size reference	Dims
R	0.075 (1.9)
A	0.079 (2.0)
B	0.157 (4.0)
C	0.157 (4.0)
D	0.157 (4.0)
E	0.157 (4.0)
F	0.157 (4.0)
G	0.157 (4.0)
H	0.157 (4.0)



Code	8mm Tape		12mm Tape	
P*	0.157±0.004 or 0.315±0.004	(4±0.1) (8±0.1)	0.157±0.004 or 0.315±0.004	(4±0.1) (8±0.1)
G	0.03 min	1.75 min	0.03 min	1.75 min
F	0.138±0.002	3.5±0.05	0.22±0.002	5.5±0.05
E	0.069±0.004	1.75±0.1	0.069±0.004	1.75±0.1
W	0.315±0.012	8±0.3	0.472±0.012	12±0.3
P_2	0.079±0.002	2±0.05	0.079±0.002	2±0.05
P_0	0.157±0.004	4±0.1	0.157±0.004	4±0.1
D	0.059±0.004 -0	1.5±0.1 -0	0.059±0.004 -0	1.5±0.1 -0
D_1	0.039 min	1.0 min	0.059 min	1.5 min

*See taping suffix tables for actual P dimension (component pitch).

Plastic Tape Reel Dimensions



Standard dimensions mm

A: 9.5mm (8mm tape)
13.0mm (12mm tape)

Cover Tape Dimensions
Thickness: 75±25μ
Width of tape:
5.5mm + 0.2mm (8mm tape)
9.5mm + 0.2mm (12mm tape)

Electrical Properties

Technical Summary and Application Guidelines

Tantalum capacitors are manufactured from a powder of highly pure tantalum metal pressed to form a slug at high pressure around a tantalum riser wire and subsequently vacuum sintered at high temperature.

The spongelike slug, although of high mechanical strength and density, is also highly porous giving a large internal surface area. This forms the positive 'plate' of the capacitor.

A dielectric layer of tantalum pentoxide is anodized on the surface of the tantalum anode, the cathode is formed by layers of manganese dioxide. Electrical contact is established by deposition of carbon onto the surface of the 'slug'. Cathode connection is then made by means of conductive contact to a lead frame. Packaging is carried out to meet individual specification and customer requirements.

This manufacturing technique is adhered to for the whole range of AVX tantalum chip capacitors.

Section 1
Electrical Characteristics and Explanation of Terms.

1.1 Capacitance

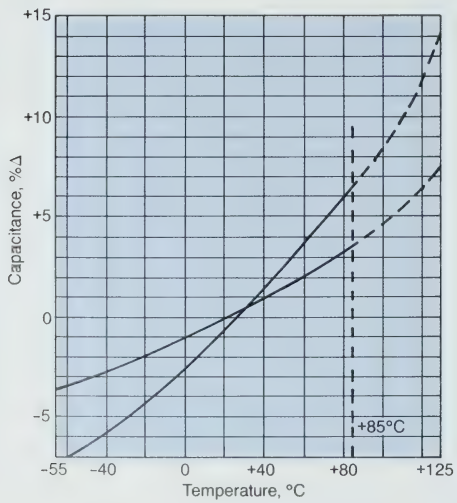
1.1.1 Rated capacitance (C_R)
This is the nominal rated capacitance. For tantalum capacitors it is measured as the capacitance of the equivalent series circuit at 25°C in a measuring bridge supplied by a 120 Hz source free of harmonics with 2.2V DC bias max.

1.1.2 Capacitance tolerance
This is the permissible variation of the actual value of the capacitance from the rated value.

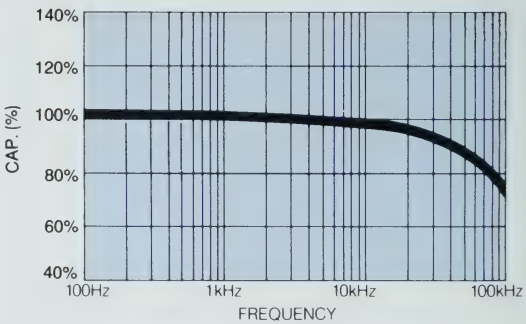
1.1.3 Temperature dependence on the capacitance
The capacitance of a tantalum capacitor varies with temperature. This variation itself is dependent to a small extent on the rated voltage and capacitor size. See Section 4 for capacitance limits at high and low temperatures.

1.1.4 Frequency dependence of the capacitance
The effective capacitance decreases as frequency increases. Beyond 100 kHz the capacitance continues to drop until resonance is reached (typically between 1-5 MHz depending on rating). Beyond this the device becomes inductive.

Typical capacitance change with temperature



Typical curve capacitance vs. frequency

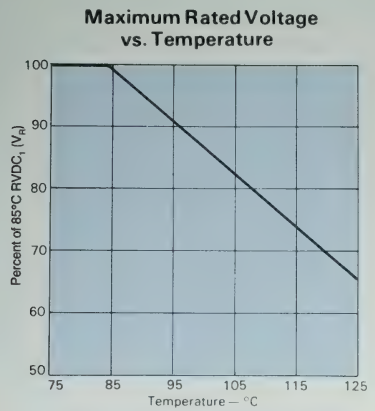


Electrical Properties and Explanation of Terms

1.2 Voltage

1.2.1 Rated DC voltage (V_R)
This is the rated DC voltage for continuous operation up to +85°C.

1.2.2 Category voltage (V_C)
This is the maximum voltage that may be applied continuously to a capacitor. It is equal to the rated voltage up to +85°C, beyond which it is subject to linear derating to 2/3 V_R at 125°C.



1.2.3 Surge voltage (V_S)
This is the highest voltage that may be applied to a capacitor for short periods of time. The surge voltage may be applied up to 10 times in an hour for periods of up to 30 s at a time. These values are not intended to apply to continuous operations. The surge voltage must not be used as a parameter in the design of circuits in which, in the normal course of operation, the capacitor is periodically charged and discharged.

85°C		125°C	
Rated Voltage (V DC)	Surge Voltage (V DC)	Category Voltage (V DC)	Surge Voltage (V DC)
4	5.2	2.6	3.4
6.3	8	4	5
10	13	6.3	9
16	20	10	12
20	26	13	16
25	33	16	21
35	46	23	28
50	65	33	40

1.2.4 Effect of surges
The solid tantalum capacitor has a limited ability to withstand surges (15% to 30% of rated voltage). This is in common with all electrolytic capacitors and is due to the fact that they operate at very high electrical stress within the oxide layer. In the case of 'solid' electrolytic capacitors this is further complicated by the limited self healing ability of the manganese dioxide semiconductor.

It is important to ensure that the voltage across the terminals of the capacitor does not exceed the surge voltage rating at any time. This is particularly so in low impedance circuits where the capacitor is likely to be subjected to the full impact of surges, especially in low inductance applications. Even an extremely short duration spike is likely to cause damage.

In such situations it will be necessary to use a higher voltage rating and it is for these applications that extended ratings have been included in TAJ series — please consult the catalog for details.

1.2.5 Reverse voltage and non-polar operation
The reverse voltage ratings are designed to cover exceptional conditions of small level excursions into incorrect polarity. The values quoted are not intended to cover continuous reverse operation.

The peak reverse voltage applied to the capacitor must not exceed:

10% of rated DC working voltage to a maximum of 1V at 25°C

3% of rated DC working voltage to a maximum of 0.5V at 85°C

1% of category DC working voltage to a maximum of 0.1V at 125°C

1.2.6 Non-polar operation
If the higher reverse voltages are essential, then two capacitors, each of twice the required capacitance and of equal tolerance and rated voltage, should be connected in a back-to-back configuration, i.e., both cathodes joined together. This is necessary in order to avoid a reduction in life expectancy.

1.2.7 Superimposed AC voltage (V_{rms}) - Ripple Voltage
This is the maximum RMS alternating voltage, superimposed on a DC voltage, that may be applied to a capacitor. The sum of the DC voltage and the surge value of the superimposed AC voltage must not exceed the category voltage, V_C. Full details are given in Section 2.

1.2.8 Voltage derating
Refer to section 3.3 (page 31) for the effect of voltage derating on reliability.

Electrical Properties and Explanation of Terms

1.3 Dissipation Factor and Tangent of Loss Angle (Tan δ)

1.3.1 Dissipation factor (DF)

Dissipation factor is the measurement of the tangent of the loss angle (Tan δ) expressed as a percentage.

The measurement of DF is carried out at +25°C and 120 Hz with 2.2V DC bias max. with an AC voltage free of harmonics. The value of DF is temperature and frequency dependent.

Note: For chip products the maximum allowed DF values are indicated in the ratings table and it is important to note that these are the limits met by the component AFTER solder reflow onto the substrate.

1.3.2 Tangent of loss angle (Tan δ)

This is a measure of the energy loss in the capacitor. It is expressed as Tan δ and is the power loss of the capacitor divided by its reactive power at a sinusoidal voltage of specified frequency. (Terms also used are power factor, loss factor, and dielectric loss, Cos (90 - δ) is the true power factor.) The measurement of Tan δ is carried out at +20°C and 120 Hz with 2.2V DC bias max. with an AC voltage free of harmonics.

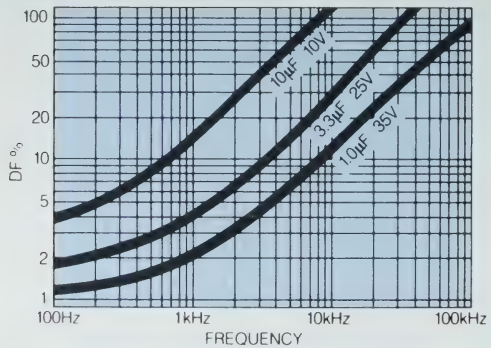
1.3.3 Frequency dependence of dissipation factor

Dissipation factor increases with frequency as shown in the typical curves below.

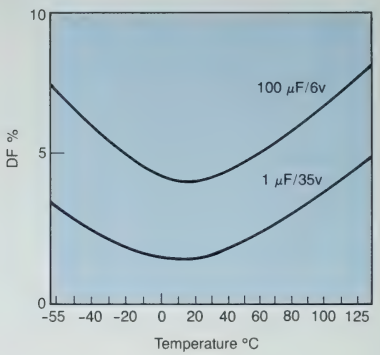
1.3.4 Temperature dependence of dissipation factor

Dissipation factor varies with temperature as the typical curves below show. For maximum limits please refer to Section 4.

Typical curve-dissipation factor vs. frequency



Typical Curves-Dissipation Factor vs. Temperature



1.4 Impedance, Z and Equivalent Series Resistance (ESR)

1.4.1 Impedance, Z

This is the ratio of voltage to current at a specified frequency. Three factors contribute to the impedance of a tantalum capacitor: the resistance of the semiconducting layer, the capacitance, and the inductance of the electrodes and leads.

At high frequencies the inductance of the leads becomes a imiting factor. The temperature and frequency behavior of these three factors of impedance determine the behavior of the impedance Z. The impedance is measured at 25°C and 100 kHz, at 0.5 VRMS max.

1.4.2 Equivalent series resistance (ESR)

Resistance losses occur in all practical forms of capacitor. These are made up from several different mechanisms, including resistance in components and contacts, viscous forces within the dielectric, and defects producing bypass current paths. To express the effect of these losses they are considered as the ESR of the capacitor. The ESR is frequency dependent. The ESR can be found by using the relationship:

$$ESR = \frac{\text{Tan } \delta}{2\pi fC}$$

where f is the frequency in Hz, and C is the capacitance in farads. The ESR is measured at 25°C and 100 kHz.

ESR is one of the contributing factors to impedance, and at high frequencies (100 kHz to resonant point) is the dominent factor, so that ESR and impedance become almost identical, impedance being marginally higher.

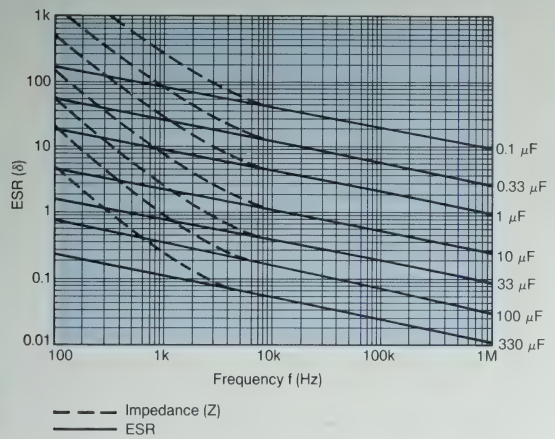
Electrical Properties and Explanation of Terms

1.4.3 Frequency dependence of impedance and ESR

ESR and impedance both increase with decreaing frequency. At lower frequencies the values diverge as the extra contributions to impedance (resistance of the semiconducting layer, etc.) become more significant.

Beyond 1 MHz (and beyond the resonant point of the capacitor) impedance again increases due to induction.

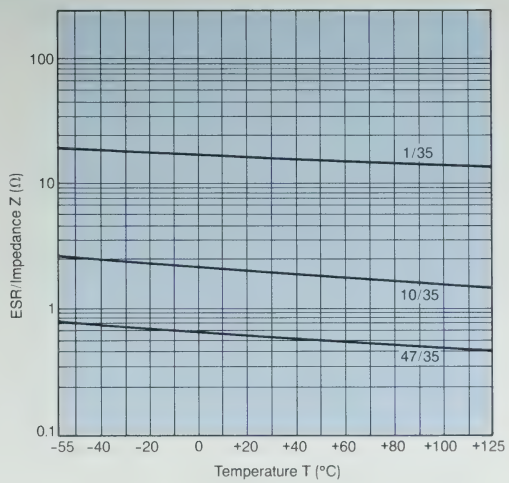
Frequency dependence of Impedance and ESR



1.4.4 Temperature dependence of the impedance and ESR

At 100 kHz, impedance and ESR behave identically and decrease with increasing temperature as the typical curves below show.

Temperature dependence of the Impedance and ESR



1.5 DC Leakage Current (DCL)

1.5.1 Leakage current (DCL)

The leakage current is dependent on the voltage applied, the time, and the capacitor temperature. It is measured at +25°C with the rated voltage applied. A protective resistance of 1000Ω is connected in series with the capacitor in the measuring circuit.

Three minutes after application of the rated voltage the leakage current must not exceed the maximum values indicated in the ratings table. Reforming is unnecessary even after prolonged periods without the application of voltage.

1.5.2 Temperature dependence of the leakage current

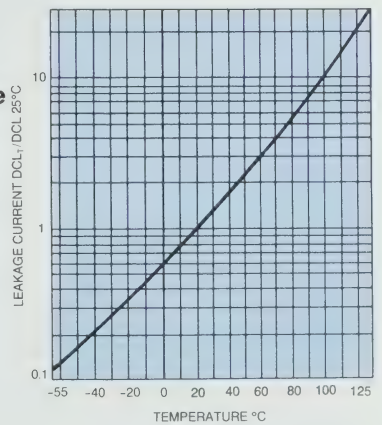
The leakage current increases with higher temperatures, typical values are shown in the graph below.

For operation between 85°C and 125°C, the maximum working voltage must be derated and can be found from the following formula:

$$V \text{ max.} = \left(1 - \frac{(T-85)}{120} \right) \times V_R \text{ volts}$$

where T is the required operating temperature. Maximum limits are given in Section 4.

Temperature dependence of the leakage current for a typical component



Electrical Properties and Explanation of Terms

1.5.3 Voltage dependence of the leakage current

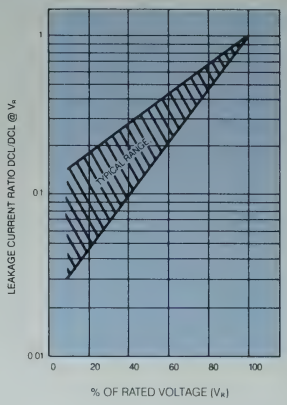
The leakage current drops rapidly below the value corresponding to the rated voltage V_R when reduced voltages are applied. The effect of voltage derating on the leakage current is shown in the graph below.

This will also give a significant increase in reliability for any application. Please see Section 3 for details.

1.5.4 Ripple current

The maximum ripple current allowance can be calculated from the power dissipation limits for a given temperature rise above ambient. Please refer to Section 2 for details.

Effect of voltage derating on leakage current



Section 2
AC Operation - Ripple Voltage and Ripple Current

2.1 Ripple ratings (AC)

In an AC application heat is generated within the capacitor by both the AC component of the signal (which will depend upon signal form, amplitude, and frequency), and by the DC leakage. For practical purposes the second factor is insignificant. The actual power dissipated in the capacitor is calculated using the formula:

$$P = I^2R = \frac{E^2R}{Z^2}$$

I = rms ripple current, amperes
R = equivalent series resistance, ohms
E = rms ripple voltage, volts
P = power dissipated, watts
Z = impedance, ohms, at frequency under consideration

Using this formula it is possible to calculate the maximum AC ripple current and voltage permissible for a particular application.

2.2 Maximum AC ripple voltage (E_{max})

From the previous equation:

$$E_{(max)} = Z\sqrt{\frac{P_{max}}{R}}$$

where P_{max} is the maximum permissible ripple voltage as listed for the product under consideration (see table).

However, care must be taken to ensure that:

1. The DC working voltage of the capacitor must not be exceeded by the sum of the positive peak of the applied AC voltage and the DC bias voltage.
2. The sum of the applied DC bias voltage and the negative peak of the AC voltage must not allow a voltage reversal in excess of that defined in the sector, 'Reverse Voltage'.

2.1 Max. permissible power dissipation (Watts) @ 25°C

The maximum power dissipation at 25°C has been calculated for the various series and are shown below, together with temperature derating factors up to 125°C.

For leaded components the values are calculated for parts supported in air by their leads (free space dissipation).

For surface mount components the free air values can be approached by correct thermal management of the board; operation in confined spaces with no heat sinking may lead to a ten-fold reduction in the dissipation required to heat the capacitor to 10°C above ambient. The ripple ratings are set by defining the maximum temperature rise to be allowed under worst case conditions, i.e., with resistive losses at their maximum limit. This differential is normally 10°C at room temperature dropping to 2°C at 125°C. In application (and this is particularly critical for chip components) circuit layout, thermal management, available ventilation, and signal waveform may significantly affect the values quoted below. It is recommended that temperature measurements are made on devices during operating conditions to ensure that the temperature differential between the device and the ambient temperature is less than 10°C up to 85°C and less than 2°C between 85°C and 125°C. Derating factors for temperatures above 25°C are also shown below. The maximum permissible proven dissipation should be multiplied by the appropriate derating factor.

For certain applications, e.g., power supply filtering, it may be desirable to obtain a screened level of ESR to enable higher ripple currents to be handled. Please contact our applications desk for information.

2.2 Voltage derating in Power Applications

For power applications (either continuous or instantaneous, i.e., in an In Circuit Test sequence where no current limiting is incorporated) additional derating should be considered. This is to compensate for any areas of the dielectric within the device becoming subject to local heating above ambient which will effectively reduce the voltage rating in that area. Please refer to section 3.3.

2.3 Power dissipation ratings (in free air)

TAJ Series - Molded Chip

Case size	Max. power dissipation (W)
A	0.075
B	0.085
C	0.110
D	0.150
E	0.165
M	0.090
N	0.130

Temperature derating factors	
Temp. °C	Factor
+25	1.0
+55	0.90
+85	0.80
+125	0.40

TAZ Series - Molded Chip

Case size	Max. power dissipation (W)
A	0.050
B	0.070
C	0.075
D	0.080
E	0.090
F	0.100
G	0.125
H	0.150

Temperature derating factors	
Temp. °C	Factor
+25	1.0
+55	0.90
+85	0.80
+125	0.40

Ripple ratings at different frequencies are detailed in Section 4 for TAJ and TAZ series.

Section 3
Reliability and Calculation of Failure Rate

3.1 Reliability

Although tantalum dielectric has essentially no wear-out mechanism and in certain circumstances are capable of limited self-healing, random failures can occur in operation.

The reliability of solid tantalum capacitors is dependent upon three key factors which affect the working environment and operating conditions:

- Operating voltage
- Operating temperature
- Circuit impedance

Operation reliability generally increases with reduction of voltage and temperature and increase of series resistance.

3.2 Base failure rate

Standard tantalum product conforms to Level M reliability (i.e., 1%/1000 hrs.) at rated voltage, rated temperature, and 0.1Ω/volt circuit impedance. This is known as the base failure rate, F(B), which is used for calculating operating reliabililty. The effect of varying the operating conditions on failure rate is shown below.

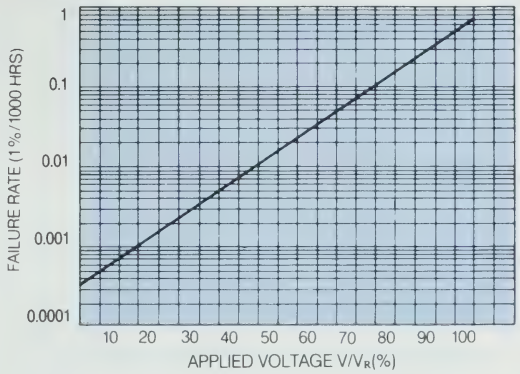
3.3 Operating voltage/voltage derating

If a capacitor with a higher voltage rating than the maximum line voltage is used, then the operating reliability will be improved.

This is known as voltage derating. The graph below shows he relationship between voltage derating (the ratio between applied and rated voltage) and failure rate. The graph gives the correction factor F(V) for any operating voltage.

For applications where less than 0.1 ohm per volt series resistance is employed, a 70% derating factor is recommended. Consult factory for further information under these conditions.

Effect of applied voltage on basic failure rate for typical component (60% con. level)

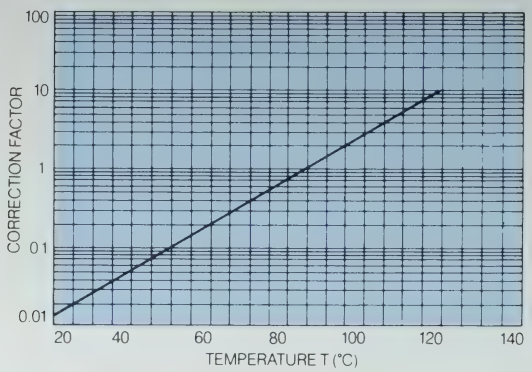


Electrical Properties and Explanation of Terms

3.4 Operating temperature

If the operating temperature is below the rated temperature for the capacitor then the operating reliability will be improved as shown in the graph below. This graph gives a correction factor F(T) for any temperature of operation.

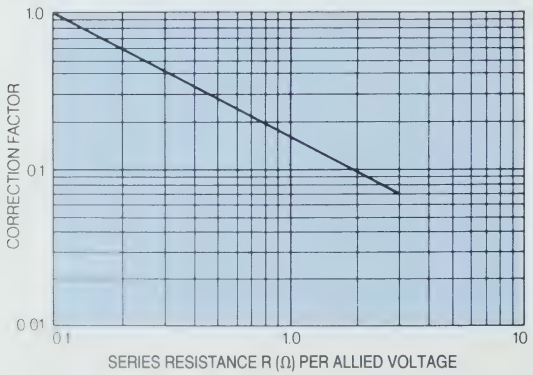
Correction factor to failure rate F for ambient temperature T for typical component



3.5 Circuit impedance

All solid tantalum capacitors require current limiting to prevent burning of the device. A series resistor is recommended for this purpose. A lower circuit impedance may cause an increase in failure rate, especially at temperatures higher than 25°C. An inductive low impedance circuit may apply voltage surges to the capacitor and similarly a non-inductive low impedance circuit may apply current surges to the capacitors, causing localized over-heating and failure. The recommended circuit impedance is 1 ohm per volt. Where this is not feasible, equivalent voltage derating should be used, see MIL HANDBOOK 217E. The graph below shows the correction factor, F(R), for increasing series resistance.

Correction factor to failure rate F for series resistance R on basic failure rate F for typical component



3.6 Reliability assessment

Operational reliability F in any circuit condition can be deduced from the three graphs above by multiplying the base failure rate, F(B), for the series by the above correction factors, F(V), F(T), and F(R).

Important note: The above analysis refers to steady-state operating conditions. The failure rate will also be affected by the presence of surges (see section 1). For AC operation please refer also to Section 2.

Worked example of a reliability calculation

For a capacitor with a 16V rating, being operated at 50°C on a 10V line with 0.8Ω per volt circuit impedance, the correction factors given by the above graphs are as follows:

F(V) = 0.04
F(T) = 0.1
F(R) = 0.2

For a series with F(B) = 1%/1000 hrs., failure rate F will be:

F = F(V) × F(T) × F(R) × F(B)
= (0.04 × 0.1 × 0.2 × 1)%/1000 hrs.
= 0.0008% per 1000 hrs. at 60% confidence level

3.7 Reliability testing

AVX performs extensive life testing of all series of tantalum capacitors.

Two criteria are especially tested:

- 2,000 hour tests as part of our regular Quality Assurance Program.
- 10,000 hour continuation tests to obtain reliability data.

Test conditions:

- 85°C/rated voltage/circuit impedance 0.1Ω/V, or =3Ω max.
- 125°C/2/3/× rated voltage/circuit impedance 0.1Ω/V, or =3Ω max.

This data is kept under continuous review.

3.8 Mode of failure

This is normally an increase in leakage current which ultimately becomes a short circuit.

Section 4
Application Guidelines for Surface Mount Tantalum Capacitors (TAJ and TAZ Series)

4.1 Qualification tests

When converting designs from through hole to surface mount, specifications should be checked to ensure compatibility with the performance standards of the surface mount devices. As a guide, test limits for TAJ and TAZ series are set out below. TAJ is qualified to IEC PQE-32 GB0003 and MIL-C-55365/8 (CWR11). TAZ is qualified to MIL-C-55365/4 (CWR09).

4.2 Qualification test limits

4.2.1 Life test

Capacitors are subjected to 85°C at rated volts, and 125°C at 2/3 × rated volts, for 2000 hrs. with 3Ω circuit impedance. After 1-2 hours recovery, components must meet:

TAJ	TAZ
ΔC_R <±10% of Initial Value	ΔC_R <±5% of Initial Value
DCL < 1.25 × Initial Limit	DCL < Initial Limit
DF < Initial Limit	DF < Initial Limit

4.2.2 Thermal shock test

Capacitors are subjected to 5 cycles of 30 mins. at -55°C followed by 30 mins. at 125°C. After 1-2 hours recovery, components must meet:

TAJ	TAZ
ΔC_R <±5% of Initial Value	ΔC_R <±5% of Initial Value
DCL < Initial Limit	DCL < Initial Limit
DF < Initial Limit	DF < Initial Limit

4.2.3 Humidity test

Capacitors are subjected to damp heat at steady state (DHSS). The conditions are 40°C with 95% RH (Relative Humidity) for 56 days. After 1-2 hours recovery, components must meet:

TAJ	TAZ
ΔC_R <±5% of Initial Value	ΔC_R <±10% of Initial Value
DCL < Initial Limit	DCL < Initial Limit
DF < 1.2 × Initial Limit	DF < 1.2 × Initial Limit

4.2.4 Climatic sequence

Capacitors are subjected to 16 hours at 125°C; accelerated DHSS (40°C/95% RH/5 × 12 hours cycle; 6 hours recovery between cycles). After 1-2 hours recovery, components must meet:

TAJ	TAZ
ΔC_R <±5% of Initial Value	ΔC_R <±10% of Initial Value
DCL < Initial Limit	DCL < Initial Limit
DF < 1.2 × Initial Limit	DF < 1.2 × Initial Limit

4.2.5 Surge testing

Capacitors are subjected to 1000 cycles of 1.3 × rated voltage for 30 seconds followed by a 30-second discharge period.

TAJ	TAZ
ΔC_R <±5% of Initial Value	ΔC_R <±5% of Initial Value
DCL < Initial Limit	DCL < Initial Limit
DF < Initial Limit	DF < Initial Limit

4.2.6 Temperature stability

Capacitors are subjected to the following sequence. Electrical requirements are tabulated below.

STEP 1 (25±2)°C
Meet initial limits for CAP, DCL, and DF

STEP 2 (-55±3)°C

TAJ	TAZ
ΔC_R <±8% of Initial Value	ΔC_R <±10% of Initial Value
DF <9%	DF <8% for $V_R \geq 20v$
	DF <12% for V_R < 20v

STEP 3 (25±2)°C

TAJ	TAZ
ΔC_R <±3% of Initial Value	ΔC_R <±5% of Initial Value
DCL < Initial Limit	DCL < Initial Limit
DF < Initial Limit	DF < Initial Limit

STEP 4 (85±2)°C

TAJ	TAZ
ΔC_R <+8% of Initial Value	ΔC_R <±10% of Initial Value
DCL < 0.1 CV_R or 1 μA*	DCL < 10 × Initial Limit
DF < 7.2%	DF < 8% for $V_R \geq 15v$ DF < 12% for V_R < 15v

Whichever is the greater

STEP 5 (125±2)°C

TAJ	TAZ
ΔC_R < +12% of Initial Value	ΔC_R <±15% of Initial Value
DCL < 0.1 CV_C or 1 μA*	DCL < 12 × Initial Limit
DF < 9%	DF <8% for $V_R \geq 20v$ DF <12% for V_R < 20v

Whichever is the greater

STEP 6 (25±2)°C

TAJ	TAZ
ΔC_R <±3% of Initial Value	ΔC_R <±5% of Initial Value
DCL < Initial Limit	DCL < Initial Limit
DF < Initial Limit	DF < Initial Limit

4.3 Mechanical and Thermal Properties of Chip Tantalum Capacitors

4.3.1 Acceleration, vibration, and shock

AVX tantalum chip capacitors are mechanically robust and meet the following performance specifications:

Acceleration
10 g (98.1 m/s)

Vibration severity
10 to 2000 Hz

Shock
Trapezoidal Pulse 10 g (98.1 m/s) for 6 ms

These conform to requirements for high speed insertion machines and meet the requirements of most automotive and aerospace applications.

For ultrasound vibration, please see section 4.3.8.

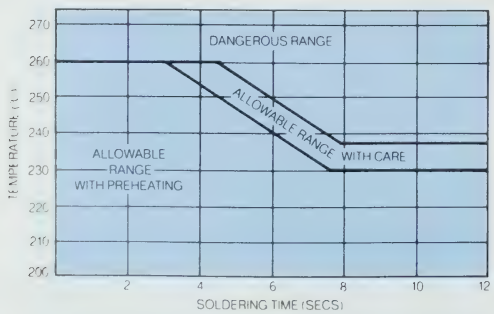
4.3.2 Soldering conditions and board attachment

The soldering temperature and time should be the minimum necessary for a good connection. A suitable combination for wave soldering is 230-240°C for 3-5 secs. For vapor phase or infrared reflow soldering the following profile shows allowable and dangerous time/temperature combinations.

The profile refers to the peak reflow temperature and is designed to ensure that the temperature of the internal construction of the capacitors does not exceed 220°C. Pre-heat conditions vary according to the reflow system used, maximum time and temperature would be 10 mins. at 150°C. Small parametric shifts may be noted immediately after reflow; components should be allowed to stabilize at room temperature prior to electrical testing.

Both TAJ and TAZ series are designed for reflow and wave soldering operations. In addition, TAZ is available with gold terminations compatible with conductive epoxy or gold wire bonding for hybrid assemblies.

Summary of allowable range of peak temp./time combinations for reflow



Typical soldering profiles recommended for tantalum chips are shown on page 35 for each process:

4.3.3 Rework

Components may be removed by soldering iron, or hot gas systems. The effect of rework cycles is cumulative — the total time at elevated temperature (including initial reflow and subsequent rework cycles) should not exceed allowed range shown above.

4.3.4 Solderability

TAJ terminations are made from NILO-42, a nickel-steel alloy. TAZ terminations are made from nickel plated Alloy 194. Both are alloys of high corrosion resistance. They are coated with electroplated, fused Sn/Pb solder (minimum Sn content: 60%) and meet the requirements of IEC 68 2.20 test Ta and MIL-STD-202, Method 208.

4.3.5 Adhesion to substrate

AVX chip components meet IEC 384-3. This requires a minimum adhesive to substrate strength of 5 Newtons.

4.3.6 Resistance to substrate bending and expansion

Because the component has compliant leads, thermal mismatch between the component and substrate (ceramic, FR4, etc.) or bending of the substrate itself, will not normally give rise to stress at the solder joint and will enhance the temperature cycling capability of the finished board.

4.3.7 Stand off and glue pad

The TAZ range has a stand-off (clearance of body from substrate when resting on terminations) of 0.15±0.15 mm. This allows a channel exists to facilitate deflux operations, especially if RMA or halide fluxes are used, and allows a glue dot to be dispensed for fixing the components to the substrate prior to wave soldering.

In the TAJ range, a glue-pad has been introduced to aid high volume onsertion: the surface of the pad is etched to provide a strong mechanical key to the glue, and the reduced clearance allows the use of ultraviolet cured epoxies. For the TAJ, A, B, and M cases, the stand-off is 0.5±0.05 mm; for C, D, N, and E cases, it is 0.1±0.1 mm.

4.3.8 Resistance to board cleaning

AVX tantalum chips have excellent solderability characteristics and are compatible with mildly activated (RMA) or pure resin flux systems. The use of high acidity fluxes is not necessary, and so subsequent board cleaning times can be minimized.

The encapsulation and termination materials are resistant to immersion in boiling solvents such as: Freon TMS, Chloroethene, Isopropyl alcohol (IPA), etc., up to 50°C.

If ultrasonic cleaning is to be applied in the final wash stages the application time should be less than 5 minutes with a maximum power density of 20 mW/cc to avoid damage to terminations. Care should also be taken to ensure that boards are firmly held and that adjacent boards are not allowed to contact each other.

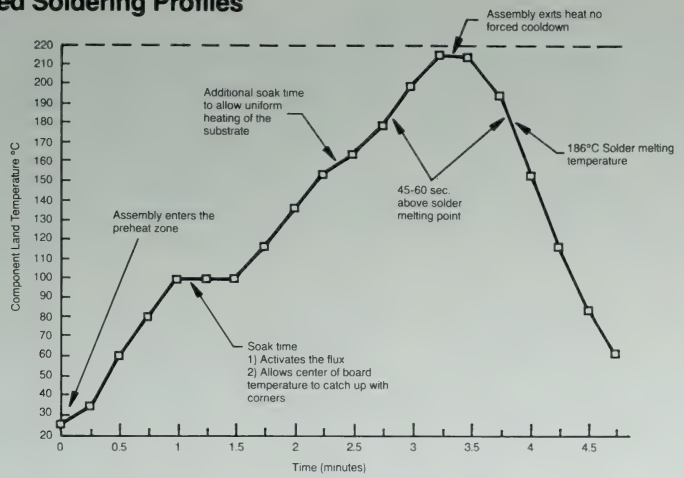
4.3.9 Flammability

AVX tantalum chip capacitors are molded with material conforming to UL94 VO flammability classification.

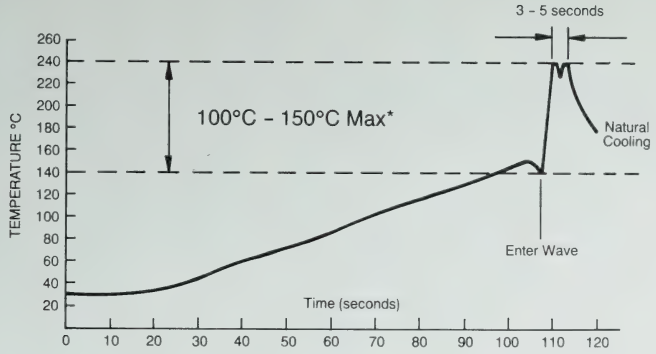
Electrical Properties and Explanation of Terms

Recommended Soldering Profiles

IR Reflow

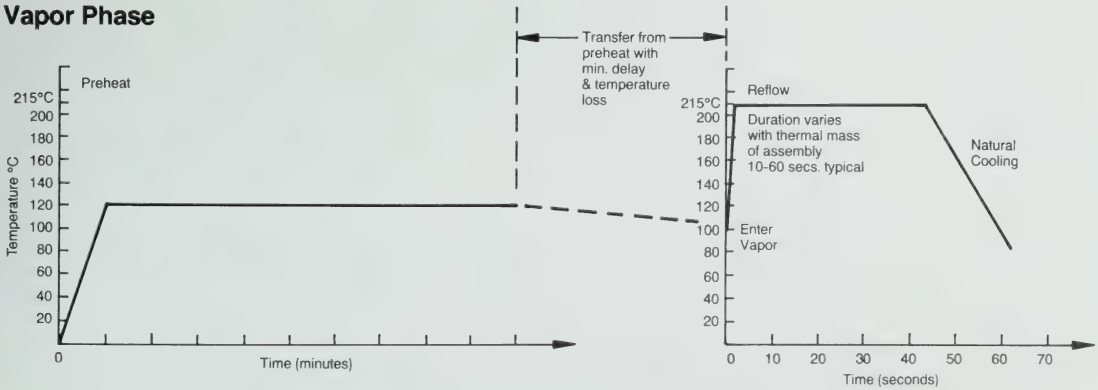

Assembly exits heat no forced cooldown
Additional soak time to allow uniform heating of the substrate
186°C Solder melting temperature
45-60 sec. above solder melting point
Assembly enters the preheat zone
Soak time
1) Activates the flux
2) Allows center of board temperature to catch up with corners
Component Land Temperature °C
Time (minutes)

Wave Soldering



*See appropriate product specification.

Vapor Phase



Cooling

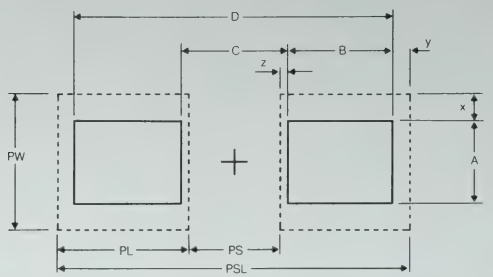
After soldering the assembly should preferably be allowed to cool naturally. In the event that assisted cooling is used, the rate of change in temperature should not exceed that used in reflow to those recommended for reheating.

Guidelines for Surface Mount Footprints

Component footprint and reflow pad design for AVX capacitors

The component footprint is defined as the maximum board area taken up by the terminations. The footprint dimensions are given by A, B, C and D in the diagram, which corresponds to W, max., A max., S min. and L max. for the component. The footprint is symmetric about the center lines.

The dimensions x, y and z should be kept to a minimum to reduce rotational tendencies whilst allowing for visual inspection of the component and its solder fillet.



Dimensions PS (Pad Separation) and PW (Pad Width) are calculated using dimensions x and z. Dimension y may vary, depending on whether reflow or wave soldering is to be performed.

For reflow soldering, the dimensions PL (Pad Length), PW (Pad Width), and PSL (Pad Set Length) have been calculated. For wave soldering the pad width (PWw) is reduced to less than the termination width to minimize the amount of solder pick up while ensuring that a good joint can be produced.

Note: these recommendations (also in compliance with EIA) are guidelines only with care and control, smaller footprints may be considered for reflow soldering.

Nominal footprint and pad dimensions for each case size are given in the following tables:

	Pad Dimensions: inches (mm)				
Case	PSL	PL	PS	PW	PWw
TAJ A	0.157 (4.0)	0.055 (1.4)	0.047 (1.2)	0.071 (1.8)	0.035 (0.9)
B	0.157 (4.0)	0.055 (1.4)	0.047 (1.2)	0.110 (2.8)	0.063 (1.6)
M	0.205 (5.2)	0.055 (1.4)	0.094 (2.4)	0.079 (2.0)	0.043 (1.1)
C	0.056 (6.5)	0.079 (2.0)	0.098 (2.5)	0.110 (2.8)	0.063 (1.6)
N	0.256 (6.5)	0.079 (2.0)	0.098 (2.5)	0.119 (3.0)	0.068 (1.7)
D	0.315 (8.0)	0.079 (2.0)	0.157 (4.0)	0.119 (3.0)	0.068 (1.7)
E	0.315 (8.0)	0.079 (2.0)	0.157 (4.0)	0.119 (3.0)	0.068 (1.7)
R	0.100 (2.7)	0.040 (1.0)	0.040 (1.0)	0.060 (1.6)	0.030 (0.8)
S	0.160 (4.0)	0.050 (1.4)	0.040 (1.0)	0.070 (1.8)	0.030 (0.8)
T	0.160 (4.0)	0.050 (1.4)	0.040 (1.0)	0.110 (2.8)	0.030 (0.8)

	Pad Dimensions: inches (mm)				
Case	PSL	PL	PS	PW	PWw
TAZ R	0.100 (2.7)	0.040 (1.0)	0.040 (1.0)	0.060 (1.6)	0.030 (0.8)
A	0.128 (3.3)	0.054 (1.4)	0.020 (0.5)	0.098 (2.5)	0.039 (1.0)
B	0.178 (4.5)	0.054 (1.4)	0.070 (1.8)	0.098 (2.5)	0.039 (1.0)
C	0.228 (5.8)	0.054 (1.4)	0.120 (3.0)	0.098 (2.5)	0.039 (1.0)
D	0.178 (4.5)	0.054 (1.4)	0.070 (1.8)	0.143 (3.6)	0.085 (2.2)
E	0.228 (5.8)	0.054 (1.4)	0.120 (3.0)	0.143 (3.6)	0.085 (2.2)
F	0.248 (6.3)	0.054 (1.4)	0.140 (3.6)	0.178 (4.5)	0.119 (3.0)
G	0.293 (7.4)	0.074 (1.9)	0.145 (3.7)	0.157 (4.0)	0.095 (2.4)
H	0.313 (8.0)	0.074 (1.9)	0.165 (4.2)	0.197 (5.0)	0.135 (3.4)

Note: Wave solder pad lengths refer to parts mounted at right angles to the direction of travel through the wave.

Electrical Properties and Explanation of Terms

4.4 Ripple Ratings

4.4.1 Thermal management

The heat generated inside a tantalum capacitor in AC operation comes from the power dissipation due to ripple (equal to I^2R where I is the rms value of the current at a given frequency and R is the ESR at the same frequency) with an additional contribution due to the leakage current.

The heat will be transferred from the internal element to the outer surface by conduction; how efficiently it is transferred from this point is dependent on the thermal management of the board.

The power dissipation ratings given in Section 2 are based on estimated free-air calculations; these can be approached if efficient heat sinking and/or forced cooling is used.

In practice, in a high density assembly with no specific thermal management, the power dissipation required to give a 10°C rise above ambient may be up to a factor of 10 less. In these cases, the actual capacitor temperature should be established (either by thermocouple probe or infrared scanner) and if it is seen to be above this limit it may be necessary to specify a lower ESR part or a higher voltage rating — please contact application engineering for details.

The following tables list ripple ratings for TAJ and TAZ series for the larger case sizes. For smaller (R, S and T) case sizes in ripple applications, please consult the factory.

25°C Ripple Ratings for TAJ (estimated free-air ratings for sinusoidal ripple)

Case Size	Cap. (nom.) μF	DC rated voltage (85°C)	Max. ESR @100kHz (ohms)	Calculated Maximum Ripple Current (mA)				Calculated Maximum Ripple Voltage (rms)			
				(100 Hz)	(1 kHz)	(10 kHz)	(100 kHz)	(100 Hz)	(1 kHz)	(10 kHz)	(100 kHz)
A	3.3	4.0	20	9	53	58	61	1.4	1.4	1.4	1.25
	4.7	4.0	8	14	85	93	97	1.4	1.4	1.1	0.81
	2.2	6.3	15	12	57	68	71	2.2	2.2	1.6	1.11
	3.3	6.3	7	18	84	99	104	2.2	2.2	1.2	0.77
	1.5	10	15	13	54	64	71	3.5	3.5	1.8	1.14
	2.2	10	7	18	79	94	104	3.5	3.5	1.5	0.80
	1.0	16	15	14	54	64	71	5.7	5.7	2.2	1.17
	1.5	16	8	19	74	88	97	5.7	5.7	1.8	0.88
	0.68	20	15	14	55	67	71	7.1	7.1	2.7	1.23
	1.0	20	9	18	71	86	91	7.1	7.1	2.3	0.97
	0.47	25	18	13	52	61	65	8.8	8.8	3.3	1.38
	0.68	25	10	18	70	81	87	8.8	8.8	2.9	1.07
	0.1	35	24	4	34	47	56	12.4	12.4	10.2	2.23
	0.47	35	13	13	57	70	76	12.4	12.4	3.6	1.24
	0.1	50	22	6	36	49	58	17.7	17.7	10.6	2.21
	0.15	50	19	6	39	53	63	17.7	17.7	7.9	1.86
	0.22	50	16	7	42	58	68	17.7	17.7	6.0	1.59
B	10	4.0	4.5	34	120	130	137	1.4	1.4	0.84	0.64
	15	4.0	3.5	39	136	148	156	1.4	1.4	0.71	0.56
	6.8	6.3	4.5	38	110	130	137	2.2	2.2	0.94	0.65
	10	6.3	3.5	43	125	148	156	2.2	2.2	0.79	0.57
	4.7	10	4.5	41	103	127	137	3.5	3.5	1.08	0.66
	6.8	10	3.5	47	117	144	156	3.5	3.5	0.91	0.58
	2.2	16	6.5	39	90	106	114	5.7	5.7	1.6	0.83
	2.2	20	6.0	33	83	107	119	7.1	7.1	1.6	0.80
	4.7	20	4.5	38	96	123	137	7.1	5.3	1.1	0.66
	1.5	25	7.5	26	69	93	106	8.8	8.8	1.9	0.91
	2.2	25	5	32	85	114	130	8.8	8.8	1.6	0.75
	0.47	35	11	20	65	79	88	12.4	12.4	3.9	1.26
	1.0	35	8	28	73	91	103	12.4	12.4	2.5	0.99
	0.15	50	19	10	43	57	67	17.7	17.7	8.4	1.98
	0.33	50	13	19	59	72	81	17.7	17.7	4.9	1.44
C	22	4	3.0	49	173	189	191	1.4	1.4	0.71	0.59
	47	4	2.2	86	216	224	224	1.4	1.2	0.57	0.50
	15	6.3	3.0	65	172	185	191	2.2	2.2	0.78	0.59
	33	6.3	2.2	86	216	224	224	2.2	1.6	0.60	0.50
	10	10	3.0	68	156	175	191	3.5	3.5	0.88	0.60
	22	10	2.2	57	203	221	224	3.5	2.1	0.65	0.51
	4.7	16	3.5	66	138	161	177	5.7	5.7	1.22	0.68
	15	16	2.2	77	202	218	224	5.7	2.9	0.73	0.52
	4.7	20	3.0	88	148	173	191	7.1	7.1	1.22	0.64
	10	20	2.2	80	182	205	224	7.1	4.0	0.85	0.53
	3.3	25	4.0	68	117	148	166	8.8	8.7	1.46	0.74
	6.8	25	3.0	88	150	172	191	8.8	5.1	1.02	0.62
	10	25	2.2	80	182	205	224	8.8	4.0	0.85	0.53
	1.5	35	6	35	80	115	135	12.4	12.4	2.25	0.96
	4.7	35	3	71	149	173	191	12.4	7.1	1.22	0.64
	0.47	50	9	23	81	100	111	17.7	17.7	4.74	1.37

Electrical Properties and Explanation of Terms

25°C Ripple Ratings for TAJ (estimated free-air ratings for sinusoidal ripple) (cont'd)

Case Size	Cap. (nom.) µF	DC rated voltage (85°C)	Max. ESR @100kHz (ohms)	Calculated Maximum Ripple Current (mA)				Calculated Maximum Ripple Voltage (rms)			
				(100 Hz)	(1 kHz)	(10 kHz)	(100 kHz)	(100 Hz)	(1 kHz)	(10 kHz)	(100 kHz)
D	47	4	2	84	242	258	274	1.4	1.4	0.64	0.56
	150	4	1.5	100	237	286	316	1.4	0.8	0.51	0.48
	22	6.3	2.5	82	215	233	245	2.2	2.2	0.79	0.63
	100	6.3	1.5	224	262	286	316	2.2	1.0	0.52	0.48
	15	10	2.5	94	140	190	245	3.5	3.2	0.87	0.64
	68	10	1.5	157	237	286	316	3.5	1.2	0.55	0.48
	10	16	2.5	118	193	225	245	5.7	4.5	1.00	0.65
	47	16	1.5	163	210	262	316	5.7	1.5	0.58	0.49
	6.8	20	2.5	100	149	198	245	7.1	6.3	1.19	0.67
	33	20	1.5	192	230	280	316	7.1	2.0	0.63	0.49
	4.7	25	3	98	117	166	224	8.8	8.2	1.43	0.75
	22	25	1.5	158	202	261	316	8.8	2.8	0.70	0.50
	3.3	35	3	64	107	156	224	12.4	11.4	1.75	0.78
	15	35	1.5	122	181	246	316	12.4	3.8	0.81	0.51
	1.5	50	5	41	102	142	173	17.7	17.7	2.70	1.05
	4.7	50	1.5	108	166	234	316	17.7	11.2	1.54	0.58
E	220	4	1.3	113	267	322	356	1.4	0.7	0.49	0.47
	150	6.3	1.4	171	258	310	343	2.2	0.8	0.52	0.48
	100	10	1.4	244	284	310	343	3.5	1.0	0.54	0.49
	68	16	1.4	209	251	303	343	5.7	1.3	0.56	0.49
	47	20	1.4	178	228	284	343	7.1	1.6	0.60	0.49
	33	25	1.4	172	220	284	343	8.8	2.7	0.70	0.50
	22	35	1.4	107	176	252	343	12.4	3.0	0.73	0.51
	10	50	1.4	118	180	255	343	17.7	5.9	1.03	0.54
M	6.8	4	6	30	107	116	122	1.4	1.4	1.02	0.76
	4.7	6.3	5.5	36	103	121	128	2.2	2.2	1.14	0.75
	3.3	10	5.5	38	96	119	128	3.5	3.5	1.32	0.77
	2.2	16	6.5	41	93	109	118	5.7	5.7	1.62	0.85
	2.2	20	6	35	86	110	122	7.1	7.1	1.62	0.82
	1	25	8	30	75	93	106	8.8	8.8	2.53	1.02
	0.47	35	11	21	66	80	90	12.4	12.4	4.06	1.30
N	47	4	2	78	225	240	255	1.4	1.4	0.60	0.52
	33	6.3	2	83	224	243	255	2.2	1.7	0.63	0.52
	22	10	2	98	146	199	255	3.5	2.4	0.69	0.53
	15	16	2	123	201	234	255	5.7	3.2	0.78	0.54
	10	20	2	123	201	234	255	7.1	4.6	0.92	0.55
	6.8	25	2.5	93	139	184	228	8.8	5.9	1.10	0.62
	4.7	35	2.5	100	120	169	228	12.4	8.3	1.34	0.65
	3.3	50	2	87	134	189	255	17.7	12.8	1.74	0.63

Temperature Derating Factors	
Temp. °C	Factor
+25°C	1.00
+55°C	0.90
+85°C	0.80
+125°C	0.40

Electrical Properties and Explanation of Terms

25°C Ripple Ratings for TAZ (estimated free-air ratings for sinusoidal ripple)

Case Size	Cap. (nom.) μF	DC rated voltage (85°C)	Max. ESR @100kHz (ohms)	Calculated Maximum Ripple Current (mA)				Calculated Maximum Ripple Voltage (rms)			
				(100 Hz)	(1 kHz)	(10 kHz)	(100 kHz)	(100 Hz)	(1 kHz)	(10 kHz)	(100 kHz)
A	2.2	4	8	14	64	75	79	1.4	1.4	0.9	0.64
	1.5	6	10	13	54	64	71	2.2	2.2	1.0	0.71
	1.0	10	12	13	50	59	65	3.5	3.5	1.3	0.78
	0.68	15	12	13	50	59	65	5.7	5.7	1.7	0.79
	0.47	20	15	12	46	54	58	7.1	7.1	2.1	0.89
	0.33	25	25	9	36	42	45	8.8	8.8	2.4	1.14
	0.22	35	30	7	31	38	41	12.4	12.4	3.2	1.26
	0.10	50	30	4	25	35	41	17.7	17.7	6.6	1.39
	0.15	50	30	4	25	35	41	17.7	17.7	4.5	1.30
B	4.7	4	8	13	82	90	94	1.4	1.4	0.8	0.75
	3.3	6	8	16	76	90	94	2.2	2.2	0.9	0.75
	2.2	10	10	15	64	76	84	3.5	3.5	1.0	0.84
	1.5	15	10	17	64	76	84	5.7	5.7	1.2	0.84
	1.0	20	12	15	59	72	76	7.1	7.1	1.5	0.92
	0.68	25	12	16	61	71	76	8.8	8.8	2.0	0.93
	0.47	35	15	16	52	63	68	12.4	12.4	2.5	1.05
	0.22	50	15	7	42	58	68	17.7	17.7	5.0	1.14
	0.33	50	18	6	38	53	62	17.7	17.7	3.2	1.16
C	6.8	4	5	31	107	116	122	1.4	1.4	0.7	0.61
	4.7	6	5	34	98	116	122	2.2	2.2	0.7	0.61
	3.3	10	6	34	84	104	112	3.5	3.5	0.9	0.67
	2.2	15	8	34	70	87	97	5.7	5.7	1.0	0.78
	1.5	20	8	27	68	87	97	7.1	7.1	1.3	0.78
	1.0	25	10	21	57	76	87	8.8	8.8	1.6	0.88
	0.68	35	10	17	60	76	87	12.4	12.4	2.2	0.89
	0.47	50	12	19	57	70	79	17.7	17.7	2.8	0.99
D	10	4	5	32	110	120	126	1.4	1.4	0.7	0.63
	6.8	6	5	35	101	120	126	2.2	2.2	0.7	0.63
	4.7	10	5	38	95	117	126	3.5	3.5	0.8	0.63
	3.3	15	6	40	83	104	115	5.7	5.6	0.9	0.70
	2.2	20	6	32	81	104	115	7.1	7.1	1.1	0.70
	1.5	25	8	25	65	88	100	8.8	8.8	1.3	0.81
	1.0	35	8	27	71	88	100	12.4	12.4	1.8	0.82
	0.68	50	9	22	68	84	94	17.7	17.7	2.4	0.88
E	15	4	4	37	132	144	146	1.4	1.4	0.6	0.58
	10	6	4	50	131	142	146	2.2	2.2	0.6	0.58
	6.8	10	4	52	119	133	146	3.5	3.5	0.7	0.58
	4.7	15	4	54	114	132	146	5.7	5.0	0.8	0.59
	3.3	20	5	60	101	118	130	7.1	6.3	0.9	0.65
	2.2	25	6	48	84	106	119	8.8	8.6	1.1	0.72
	1.5	35	6	31	71	101	119	12.4	12.4	1.5	0.73
	1.0	50	6	29	71	101	119	17.7	17.7	2.0	0.74

Electrical Properties and Explanation of Terms

25°C Ripple Ratings for TAZ (estimated free-air ratings for sinusoidal ripple) (cont'd)

Case Size	Cap. (nom.) µF	DC rated voltage (85°C)	Max. ESR @100kHz (ohms)	Calculated Maximum Ripple Current (mA)				Calculated Maximum Ripple Voltage (rms)			
				(100 Hz)	(1 kHz)	(10 kHz)	(100 kHz)	(100 Hz)	(1 kHz)	(10 kHz)	(100 kHz)
F	33	4	3	68	172	178	178	1.4	1.0	0.5	0.53
	22	6	3	61	160	173	178	2.2	1.4	0.5	0.53
	15	10	3	64	145	163	178	3.5	2.0	0.6	0.53
	10	15	3	82	140	160	178	5.7	2.9	0.6	0.53
	6.8	20	3	82	138	162	178	7.1	4.2	0.7	0.54
	4.7	25	4	63	108	137	154	8.8	5.3	0.8	0.62
	3.3	35	4	57	100	137	154	12.4	7.5	1.0	0.62
	1.5	50	4	37	91	131	154	17.7	11.2	1.3	0.63
	2.2	50	4	37	91	131	154	17.7	16.4	1.7	0.64
G	68	4	2	74	177	213	235	1.4	0.7	0.5	0.47
	47	6	2	76	174	211	235	2.2	0.9	0.5	0.47
	33	10	2	78	172	208	235	3.5	1.2	0.5	0.47
	22	15	2	78	151	194	235	5.7	1.8	0.5	0.47
	15	20	3	74	109	148	191	7.1	2.1	0.6	0.57
	6.8	25	3	60	98	140	191	8.8	4.5	0.7	0.58
	10	25	3	60	98	140	191	8.8	3.1	0.7	0.58
	4.7	35	3	84	100	142	191	12.4	6.5	0.9	0.58
	3.3	50	3	67	112	157	191	12.7	9.3	1.1	0.58
H	100	4	1	114	271	327	361	1.4	0.7	0.4	0.36
	68	6	1	180	271	327	361	2.2	0.9	0.4	0.36
	47	10	1	186	240	299	361	3.5	1.3	0.4	0.36
	33	15	1	220	263	319	361	5.7	1.8	0.4	0.36
	22	20	1	181	231	299	361	7.1	2.6	0.4	0.36
	15	25	1	139	207	281	361	8.8	3.8	0.5	0.36
	6.8	35	1	148	220	292	361	12.4	8.4	0.9	0.37
	4.7	50	1	124	189	268	361	17.7	12.2	1.3	0.38

Temperature Derating Factors	
Temp. °C	Factor
+25°C	1.00
+55°C	0.90
+85°C	0.80
+125°C	0.40

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